MODERN PLASTICS

JUNE 1948

NON-BLEEDING Durez compounds are *aloof*. They have no trouble at all in resisting the blandishments of acidic organic materials, alcohol solutions, dry cleaning fluids. As one of the group of Durez phenolic compounds that serve so widely in industry, these plastics have excellent dimensional stability, low moisture absorption, and permanent, lustrous finish.

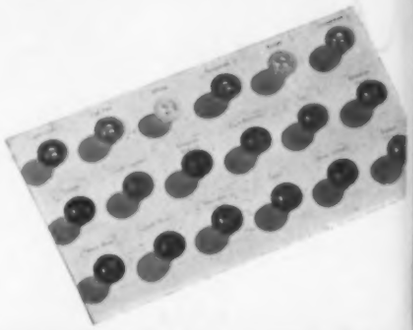
Non-bleeding Durez does not give off odor or taste . . . does not chip or shatter. It makes closures and caps that screw down tightly, loosen easily, and do not leak . . . buttons that stay bright through many cleanings and pressings.

Whether your materials problem calls for non-bleeding or totally different characteristics, the answer may well be in Durez. We offer you and your molder the advantages of greatly increased capacity and rigid uniformity control. Let us send you "Durez Plastics News", showing each month what others are accomplishing with Durez. Durez Plastics & Chemicals, Inc., 126 Walck Road, North Tonawanda, N. Y. *Export Agents: Omni Products Corp., 460 Fourth Avenue, New York 16, N. Y.*

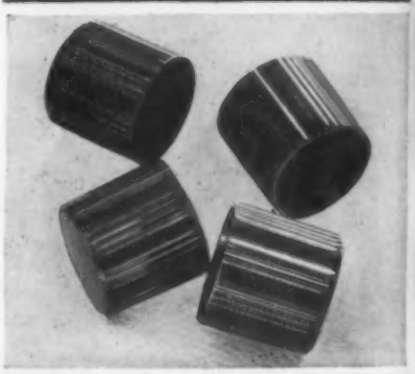
Use Durez when the plastic must

keep itself to itself

TOILET GOODS



BUTTONS



LIQUOR CAPS

MEDICINE CLOSURE

TOILET GOODS. Alfred Dunhill men's toiletries are topped off with closures of rich brown Durez having a molded-in groove that holds a polished brass saddle-piece firmly in place. Durez phenolic closures on leading lines have met with tremendous public preference.

BUTTONS. Durez buttons meet every test. They resist fracture and chipping at the cleaner's. They retain their sparkling color and surface smoothness when subjected to cleaning or washing compounds. And Durez lends itself to infinite freedom in design.

LIQUOR CAPS. A widely accepted component of good liquor "costuming" is a Durez cap. The phenolic material is free from corrosion, will not contaminate delicate flavors. Durez caps have a pleasant feel and a quietly decorative lustre.

MEDICINE CLOSURE. The Upjohn Company uses a unique type of Durez cap that holds and encloses the rubber dropper bulb on its Tincture Mercresin bottle. The cap is unaffected by acids and other chemicals, has impact strength necessary in a re-use application.

DUREZ — PHENOLIC RESINS — MOLDING COMPOUNDS — INDUSTRIAL RESINS — PROTECTIVE COATING RESINS

PHENOLIC PLASTICS THAT FIT THE JOB

AN OUNCE OF *Loalin* "PACKS A POUND OF PUNCH"...FOR PENNIES!

(CATALIN POLYSTYRENE)

If your plastic-projected idea looks good on paper . . . and you are ready to go ahead—check the material advantages of *Loalin!* As the lightest weight plastic, *Loalin* polystyrene is also the thriftiest. It costs little, and *that* little goes a long way. By delivering more injection-molded pieces per pound, it stretches the sponsor's dollar . . . adds to the product's purchase appeal . . . yields a greater sales return.

For example, TWINTYPE, above . . . the picture progresses an idea as the designer first visualized it, and as the molder, using *Loalin*, carried through the specifications. You see it, too, as the manufacturer intended it . . . a *frame-work* for increased product sales. You also foresee its duo-frame as converted to a life of decorative and intimate re-usefulness.

When planning your next product or package, Catalin's experienced technical staff shall be glad for a before-hand opportunity to discuss "our family" of plastics with you, and to suggest the proper material, and processing method. Inquiries invited!

Credits: Twintype Frames, created by Design Associates Ltd. for La Cross; custom molded by Sterling Plastics Co., Union, N. J. Pencil sharpener and ruler, shown in picture, also molded of Loalin, are proprietary items of Sterling Plastics Co.

CATALIN
THE GEM OF PLASTICS
Catalin

CATALIN BOOKLET! FREE!

Cast Phenolics • Liquid Resins • Molding Compounds

Sixteen pages of illustrations, applications, information, physical properties, etc. . . . a valuable compilation for designers and manufacturers. Your letterhead request brings your copy by return mail.

CATALIN CORPORATION OF AMERICA

ONE PARK AVENUE • NEW YORK 16, N. Y.

MODERN PLASTICS*

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* Reg. U. S. Patent Office.

TWO NEW PLASTICIZERS FOR VINYL RESINS

New Hycar Nitrile Polymers make processing easier and widen fields for makers of many products

THIS news is important to any company dealing in any way with the vinyl resins. The new Hycar EP (easy processing) and Hycar NS (easy-processing, non-staining) offer exceptional advantages. These are nitrile rubbers that really *blend* with the vinyls. Check these properties:

★ **PERMANENT CEMENTABILITY** — **because these plasticizers are non-migrating and non-volatile. (Of vital interest to any manufacturer of products requiring cemented construction.)**

★ **STABILITY** — **won't get brittle, won't evaporate.**

★ **NON-MIGRATING** — **won't soften or pick up varnish.**

★ **EASY PROCESSING** — **and a more perfect blend either on a mill or in a Banbury. Calenders and extrudes *smoothly*.**

★ **HIGHER LOADING** — **economy in products where the price per pound of the compound is important.**

★ **WIDER LATITUDE** — **in color and color stability, particularly with those hard-to-do pastels.**

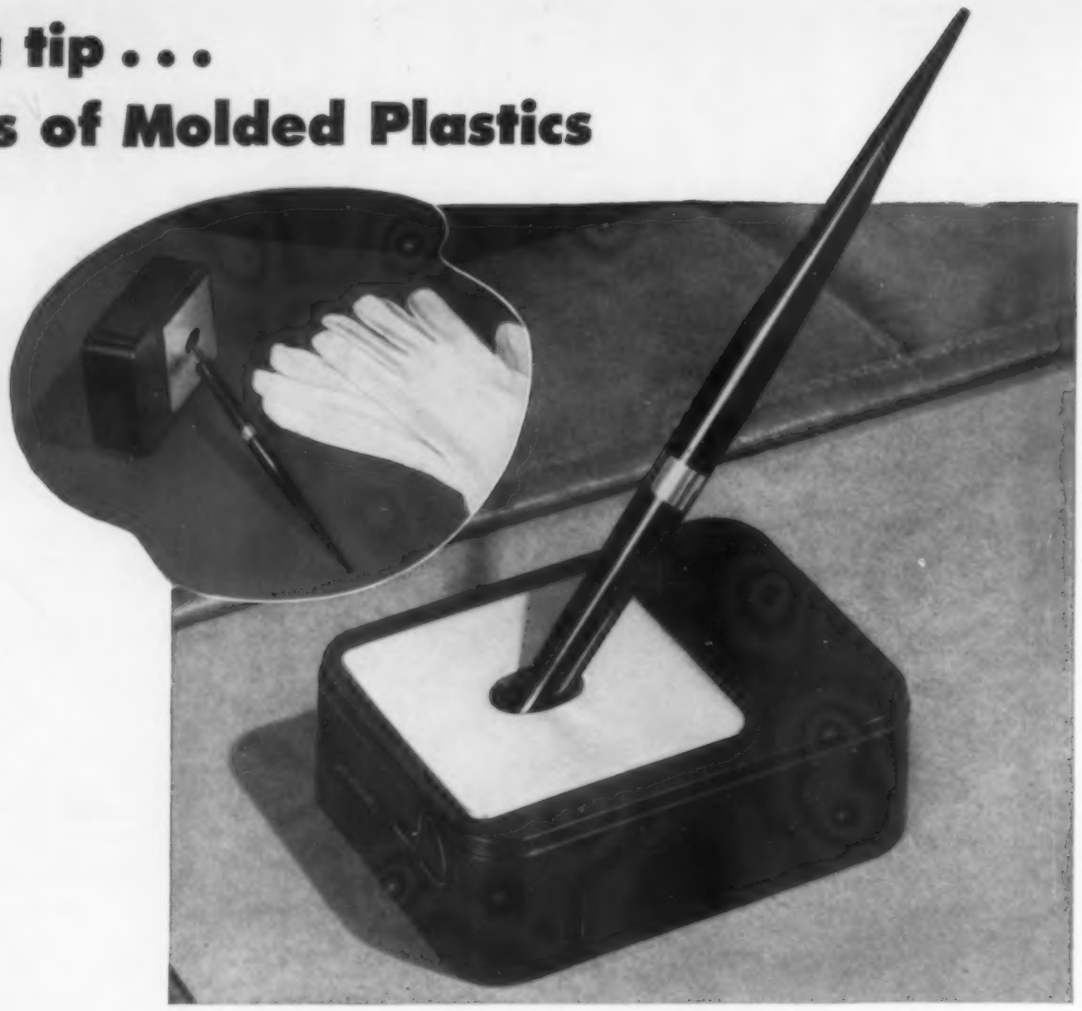
Our service bulletin, 48-H1, on the use of the new Hycar American Rubber with the vinyl resins, will be sent on request. We make no finished products from Hycar or any of our other raw materials, but we are glad to help in the development work on any special applications. Write Dept. O-6, B. F. Goodrich Rubber Company, Rose Building, Cleveland 15, Ohio.

Hycar Reg. U.S. Pat. Off. *American Rubber*

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

Here's a tip . . .
for users of Molded Plastics



In order to merchandise this new item properly a quantity of the bases were molded wholly of transparent material. This permits a clear view of all parts. These units are being used to explain and demonstrate the revolutionary "Safeguard" principles to the trade.

Tip the base of this new Sheaffer "Safeguard" Dip-Type Desk Set on its side . . . stand it on either end . . . turn it over, bottom up. The chances of spilling are negligible. Here is another notable contribution to writing ease and pleasure, thanks to Sheaffer engineering . . . and to Chicago Molded Plastics.

Naturally, the requirements for the plastics base parts of the "Safeguard" Desk Set were exacting . . . fine appearance to match Sheaffer quality; accuracy, for ease of assembly and proper functioning; and dependable production, to keep up with the demand created by Sheaffer's national advertising. So the job was placed with Chicago Molded . . . tools were designed and fabricated by CMPC . . . and parts injection molded of polystyrene in CMPC's spacious, fully equipped Thermoplastics Division.

Your requirements are, perhaps, vastly different. But this job is, we believe, another example of the ability of CMPC . . . the knowledge, experience, and facilities . . . to meet the requirements of 'most any molded plastics job.

So . . . whatever your plans call for . . . thermoplastic materials or thermosetting . . . injection molding or compression . . . large parts or small . . . you'll find it worthwhile to discuss them with a CMPC Service Engineer. There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

Representatives in principal industrial centers

COMPRESSION *and* **INJECTION** *molding of all plastic materials*

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EDITORIAL

A Giant Partner

Any man whose livelihood depends upon plastics is almost certain to ruminate over the ever-increasing activity of the rubber industry in plastics.* Rubber companies, processors, and equipment suppliers are deeply involved, not only in film and coated products, but also in extrusion, injection, and compression molded products.

The recent legislation prolonging government control of GR-S synthetic rubber—the $700,000,000 enigma that can be solved only by time—is particularly important to the rubber people because the continued improvement being made in GR-S, and the numerous offshoots derived from rubber chemicals used in its manufacture, would give them another group of materials to work with whose basic properties they know well. GR-S is not thought of as a plastic in the same sense as polystyrene, acetate, saran, phenolic, vinyl, etc., but, nevertheless, it can compete in a vast array of consumer and industrial items.

Furthermore, GR-S synthetic rubber competes for the same scarce raw materials used for plastics. If GR-S production goes at a rate of over 500,000 tons annually, benzol and styrene will be tight, and plastics materials will be affected accordingly; but if GR-S ever goes far below the present Government-set minimum of 200,000 tons, styrene monomer could be dripping from producers' eyebrows.

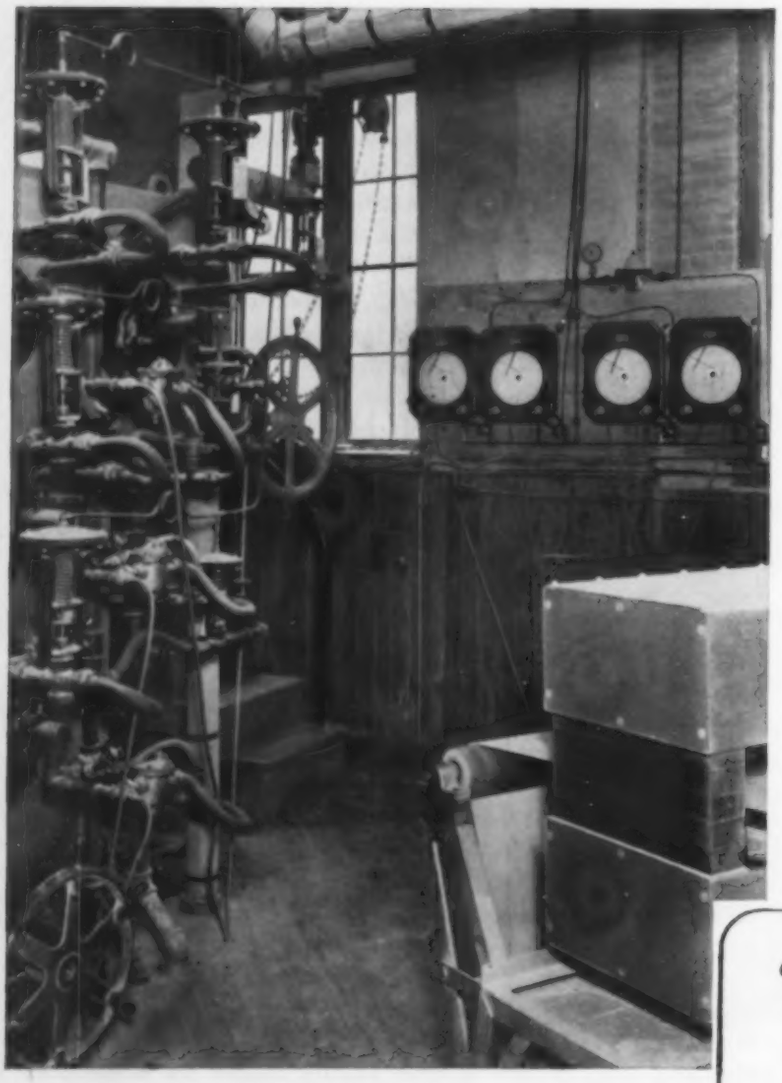
In addition to the competitive and supply angles, there has also been developed a comparatively new group of resins made by changing the amount of styrene and butadiene used in the standard GR-S formula and by adding other chemicals and fillers to obtain a wide variety of properties. The rubber companies are already knocking at the door of the plastics industry with a variety of compounds, including high-impact, high temperature-resistant materials that can be made from these rubber chemicals.

Fortified with these materials, plus vinyls and the special purpose rubbers such as Buna N, butyl, and Neoprene, together with their acquired knowledge in handling phenolics, saran, and other plastics, the rubber industry is set to greatly expand its interests in the plastics industry. This time they have no intention of being caught napping as they were when molded phenolics caught up with hard rubber. Whether or not the marriage of plastics and rubber is a shot-gun type or one of true affinity makes no difference. Rubber's activity in plastics is a portent of future greatness —a testimony to a giant industry's faith in the future of plastics.

*See also "Rubber or Plastics?", p. 89.

WANT UNIFORMLY CALENDERED SHEETS?

Specify Taylor Accurate Temperature Control!



Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

IF you haven't got uniform temperature in your calender roll, you can't get uniform sheets—whether you're calendering rubber, plastics, or rubber-impregnated fabrics. But a panel of Taylor Fulscope Controllers like this (left) will *assure you of uniform roll temperature* by automatically controlling both steam and cooling water.

Too high a temperature can make the sheets run over-thin. Too cool and they're likely to require re-processing. But automatic Fulscope Control keeps the temperatures—and the sheets—consistently uniform. Production costs are cut to rock bottom because one instrument controls both heating and cooling valves automatically.

If your manufacturing process involves calenders, an automatic Taylor Control System like this will do wonders in keeping quality uniform and costs down. Ask your Taylor Field Engineer! Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

FLYING BASIN TRAVELS LIGHT—MADE OF DU PONT "LUCITE"

Saves weight on planes . . . boats and trains, too!

IN KITCHEN OR GALLEY, this sink of "Lucite" lessens the load. It's formed by a combination of processes—pressing, vacuum-drawing and blowing. "Lucite" is not affected by citrus and other food acids . . . resists most chemicals, heat and aging, and it's easy to maintain. Week after week, manufacturers are bringing out new or improved products of "Lucite."

Soon you may be seeing basins like this—almost any way you travel. For fixtures made of "Lucite" are excellent wherever deadload must be kept light . . . on aircraft, water-craft, trailers and trains.

Weighing only 7¼ lbs., without fittings, this basin of "Lucite" acrylic resin combines colorful, gleaming beauty with dependable durability. Tests show that the basin withstands hot water—has excellent dimensional stability, is resilient and shatter-resistant.

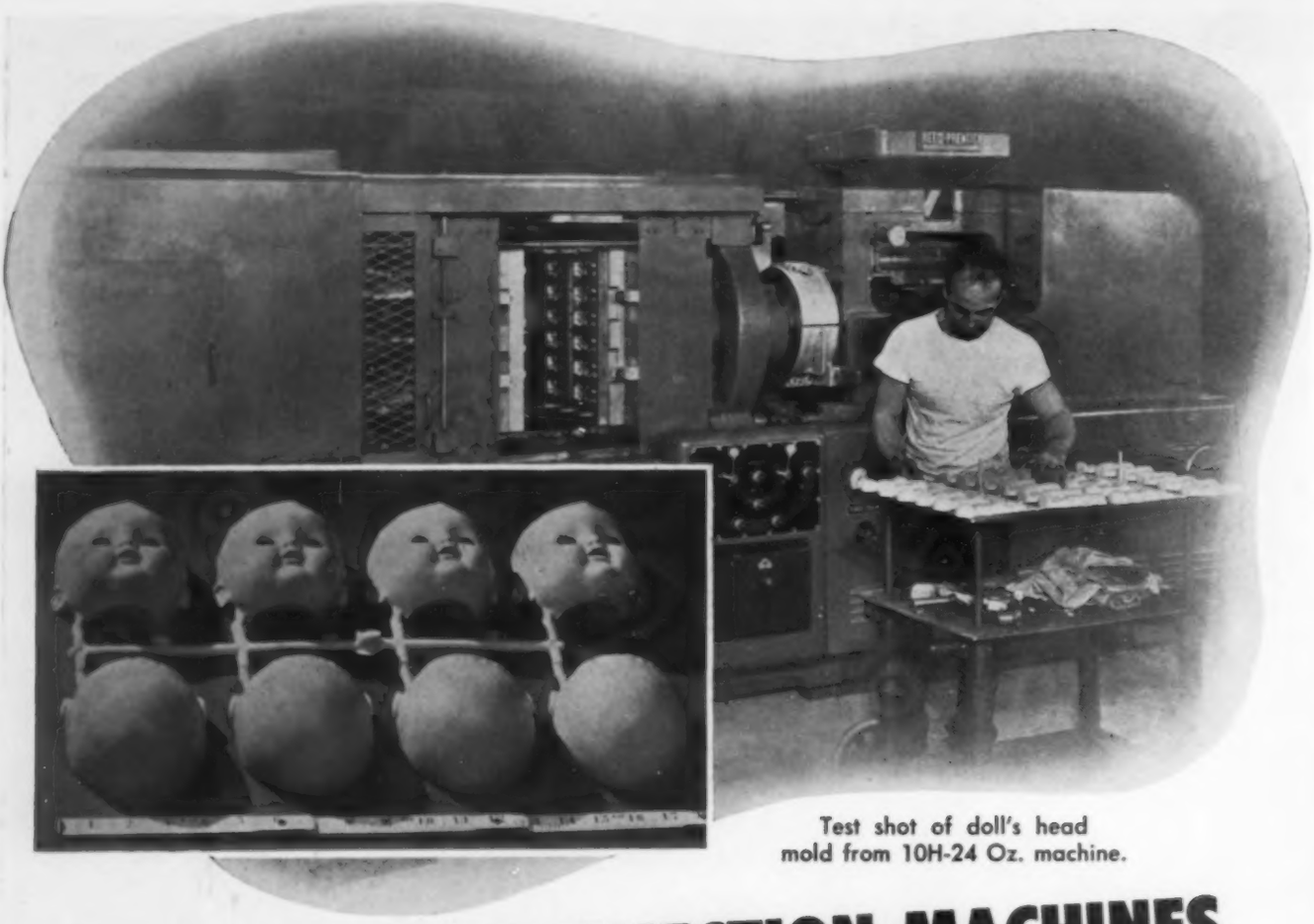
For other applications, manufacturers prefer "Lucite" because of its weather-resistance, its crystal-clarity (transmits up to 92% of visible light) and the ability to "pipe" light around corners. "Lucite" is available in many colors—transparent, translucent and opaque. What's more, it's readily fabricated or molded.

How about *your* products? Perhaps you will profit with "Lucite" or another Du Pont plastic . . . in developing a new product or improving an old one. Write for literature. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 366, Arlington, N. J.

Basin and sink manufactured by American Plastic Products, Inc., Millburn, New Jersey.

Tune in to Du Pont "CAVALCADE OF AMERICA," *Monday nights—NBC coast to coast.*

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



Test shot of doll's head mold from 10H-24 Oz. machine.

REED-PRENTICE INJECTION MACHINES
. . . used to test Mold Performance!

Guy P. Harvey & Son Corp., Leominster, Mass., one of the country's foremost plastic mold makers, uses Reed-Prentice 10H-24 Oz. and 10D-8 Oz. injection machines for final test of molds under actual operating conditions.

The Reed-Prentice machines in this testing laboratory handle a cross-section of the most difficult molding problems encountered throughout the industry. Materials of a wide range are used . . . difficult molds of intricate construction are handled . . . in fact, the versatility of these machines make them adaptable for the testing of all types of molds, whether they are of single or multiple cavity design.

The 10H-24 Oz. model (illustrated above) is particularly suited for accommodating the large molds which are being used more and more in plastic production. It has the outstanding features of all Reed-Prentice machines — including absolute control of the three vital molding variables . . . time, temperature and pressure!

Specifications of this 10H-24 Oz. machine are: size of die plates 30" x 30"; maximum die space 20"; minimum die space 8"; pressure on material 24,500 lbs. per sq. inch; mold closing pressure 600 tons; cycle, 150 shots per hour (varying with type of mold and material).

Molders everywhere are taking advantage of the features incorporated in these injection machines for profitable production. Investigate the complete Reed-Prentice line — write NOW for information on the 4, 8, 10, 12, 16 or 24 Oz. capacity models. An inquiry addressed to Dept. D will bring detailed machine specifications.

THE WORLD'S LARGEST MANUFACTURERS OF INJECTION MOLDING MACHINES

NEW YORK
75 West Street

CLEVELAND
1213 W. 3rd Street

INJECTION
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

LOS ANGELES
2328 S. Santa Fe Ave.

HERE is a case where Lumarith solves a difficult problem for an industry—making possible the high speed production of simulated pearls from Lumarith plastic cores instead of foreign-made glass cores.

Only Lumarith meets the pearl manufacturer's rigid plastics specifications of *superior machinability and precise color and translucency control.* In addition, bead cores made of Lumarith:

- Eliminate dependence on foreign imports.
- Have unmatched affinity for lacquer coatings.
- Acquire permanent finish that won't chip or peel.
- Have unexcelled surface lustre, color depth and roundness.
- Can be machined for smooth-rimmed thread holes that won't cut.
- Are light enough for multiple strand necklaces.

Why not review your product plans with a Celanese representative. He may be able to demonstrate how Lumarith, or one of the other Celanese *cellulosic* plastics, can help you turn out your product—faster, better and more economically.

CELANESE CORPORATION OF AMERICA
Plastics Division, Dept. D-I
180 Madison Avenue, New York 16

LUMARITH*
FORTICEL*
CELLULOID*
VIMLITE*
CELCON*

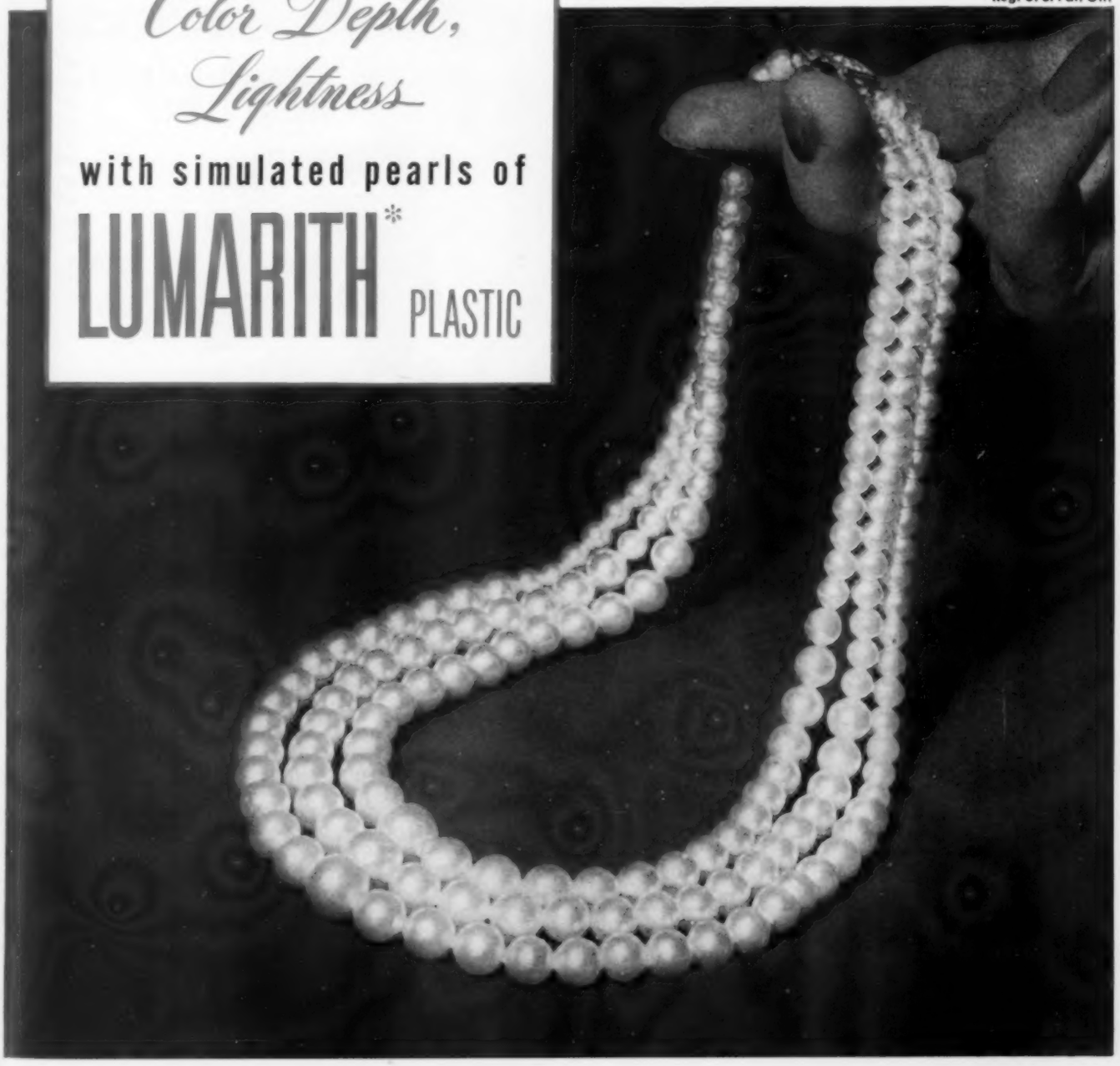
Celanese Plastics*

*Reg. U. S. Pat. Off.

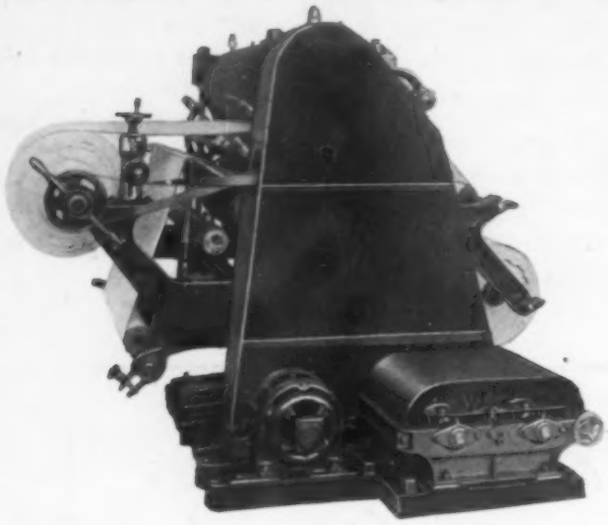
Warmth, Lustre, Color Depth, Lightness

with simulated pearls of

LUMARITH* PLASTIC



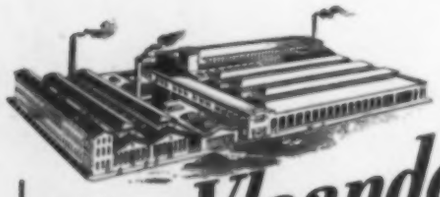
Cut Costs with HIGH SPEED ROTARY EMBOSSERS



The 2-roll embossing machine illustrated is only one of the many types of embossers we build for the textile industry. It's built for speed. It's designed for heavy-duty continuous performance. Like all Van Vlaanderen equipment, it has proven itself in actual operation in leading textile mills.

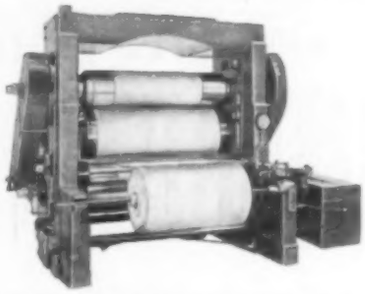
And because it's standard equipment, you don't pay extra for the cost of designing it, nor do you risk poor performance on your production line.

Many of our other standard textile machines are ideally suited for processing synthetic fabrics, film and sheeting. Check the list at the bottom of the page, then write for detailed information. Our reply may furnish you with profitable shortcuts to faster, better production.



Van Vlaanderen
MACHINE COMPANY
370 Straight Street, Paterson, New Jersey

USE THESE STANDARD MACHINES FOR SYNTHETIC FABRICS



CALENDERING. Calendering machines for synthetic fabric processing are available in many different types and all tonnages. These machines work exceptionally well for chloride monofilms and Saran. All are designed for cold or hot calendering by steam or gas.

EXPANDER. Expanders are available in many different types for keeping rolls of material free of wrinkling. One or more expanders can be installed on practically all types of finishing machines to facilitate handling at take-up and let-off end of rolls.

BLEACHERS • BREAKERS • CALENDERS • CALENDER DRYERS • CONTINUOUS WASHERS • COOLING CYLINDERS • COTTON BACK FINISHER DRYERS—ALL TYPES • DYEING MACHINES • ELECTRIC GUIDERS • EMBOSSING MACHINES • EXPANDERS • EXTRACTORS • FLOCK PRINTING MACHINES • HEATING TOWERS • HYDRAULIC CALENDERS • IMPREGNATING MACHINES • MANGLES • MEASURING MACHINES • MIXING KETTLES • PAD DYEING MACHINES • PRINT WASHERS • ROLLING-UP MACHINES • ROLLS—RUBBER—PAPER • SINGEING MACHINES • SLACK PRINT WASHERS • SOAP WASHING MACHINES • SQUEEZERS • SUCTION MACHINES • TENSIONLESS CONSTANT SPEED DYE JIGS • TENTER FRAMES • TUBING MACHINES • WINDERS •

1868-1948
CELLULOSE NITRATE
THE
VERSATILE
PLASTIC

TOUGH

BUT ALSO COLORFUL

In NIXON C/N (Cellulose Nitrate) the plastic fabricator has that unusual combination of Toughness and Colorfulness. Rods, Tubes, and Sheets come in clear or colored transparent, colored translucents and opaques, plain or mottled . . . in hundreds of color combinations. Tubes and Sheets are available in practically a limitless number of striped, mottled, and geometric designs. Whenever color is an important factor . . . or cost for that matter . . . consider a cellulosic such as NIXON C/N. It is a practical plastic suitable for the fabrication of many products.

NIXON
C/N
CELLULOSE
NITRATE

NIXON NITRATION WORKS • NIXON • NEW JERSEY

Representatives: New York, Chicago, Detroit, St. Louis, Leominster • *Sales Agents:* NORTHWEST PLASTICS INDUSTRIES, Portland, Oregon; Seattle, Washington
Canadian Distributors: CRYSTAL GLASS AND PLASTICS, LTD., Toronto, Can. • *Export Distributors:* OMNI PRODUCTS CORP., 460 4th Ave., N. Y. 16, N. Y.

MOSINEE

"More than Paper"

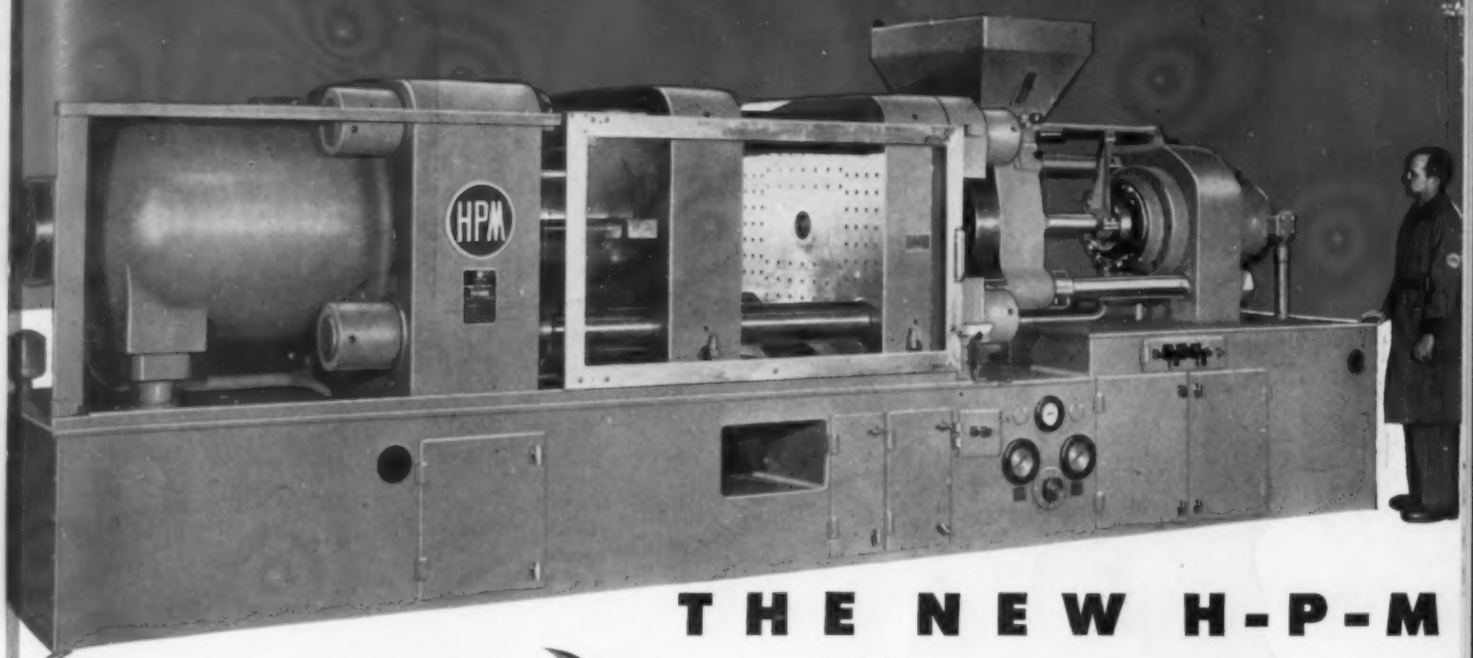
To the plastics industry, MOSINEE stands for paper-base processing materials with scientifically controlled chemical and physical properties, quality and uniformity . . . high tensile and tear strength with high absorptive capacity.

Other technical characteristics are controlled to meet specific plastics production requirements.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

"Essential Paper Manufacturers"

For those BIG JOBS!



THE NEW H-P-M "40oz."

This giant H-P-M "all-hydraulic" injection molding machine opens up an untouched market for the plastics molder. Size and weight are no longer limiting factors. Refrigerator parts, radio cabinets, toilet seats, large instrument housings are typical examples which can now be molded on a production basis with this new H-P-M. There is a demand for big plastic parts. Are you prepared to make them?

There's plenty of die mounting space, daylight and stroke. There's ample plasticizing capacity for the fastest possible cycle. This new H-P-M 40 ounce will put your plastics department in a position to handle those big jobs on a profitable basis. Check the money saving H-P-M features. Write today for complete specifications.

H-P-M'S 6 STAR EXTRA MONEY SAVING FEATURES

- **PROVEN DESIGN:** H-P-M machines incorporate design "know how" based upon 71 years' experience!
- **FAST MOLD CYCLE:** H-P-M Injection machines are the fastest in the industry!
- **QUICK MOLD SET-UP:** No adjustments are required for molds of different thicknesses!
- **VERSATILE APPLICATION:** Full hydraulic control makes H-P-Ms adaptable to many sizes and types of molds.
- **DEPENDABLE SERVICE:** A rugged design powered by H-P-M heavy duty radial pumps, valves and controls.
- **COMPLETE RANGE OF SIZES:** There's an H-P-M for every molding need — 4, 9, 16 and 40 ounces per cycle.

BULLETIN 4802 WILL GIVE YOU SPECIFICATIONS ON THE COMPLETE LINE OF H-P-M INJECTION MACHINES.

Write for it Today!

THE HYDRAULIC PRESS MANUFACTURING CO.

1010 Marion Road • Mount Gilead, Ohio, U. S. A.

Branch Offices in New York, Cincinnati, Cleveland, Columbus, Detroit, Pittsburgh and Chicago. Representatives in other principal cities.

Export Dept.: 500 Fifth Avenue, New York, N. Y. Cable — "Hydraulic"

HPM

All-Hydraulic Self-Contained

Injection Machines

FOR MOLDING THERMO PLASTICS

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

For LOW-COST LUSTRE-FINISHING of GATES and FLASHES

BELTS AND ENGINEERING BY BEHR-MANNING

Unscarred lustre sells, so whenever the all-over mold-lustre of a plastic product is marred by ugly gate and flash scars, eye-appeal and sales suffer.

Removal of gates and flashes and restoration of true mold lustre are "necessary evils" of mold design. They must be done as painlessly as possible.

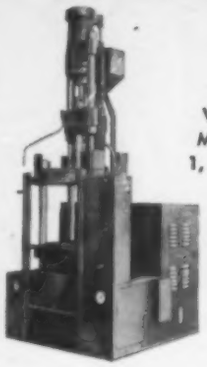
Behr-Manning has developed belts and finishing methods which in many cases have reduced flash removal, blending and lustre-finishing to one-station jobs. In the belief that these same plastics-finishing belts and methods-engineering services may likewise help your production, we invite you to submit samples of your product for "shortcut" test.

QUALITY ABRASIVES

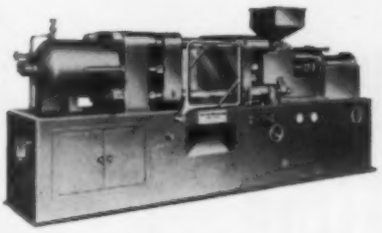
BEHR-MANNING • TROY, N. Y.

(DIVISION OF NORTON COMPANY)

QUALITY COATED ABRASIVES SINCE 1872

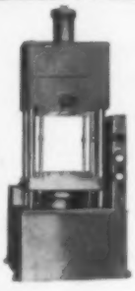


Vertical Injection
Molding Machines
1, 2, and 4 Ounces



Horizontal Injection Molding Machines
8 to 80 Ounces

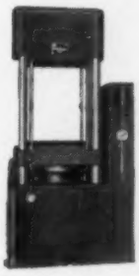
Preform
Tableting Machines
—10 and 100 Tons



Transfer
Molding Machines
30 to 1200 Tons

General Purpose Presses
20 to 200 tons

Compression
Molding Presses
50 to 1200 Tons



Only WATSON-STILLMAN OFFERS THESE SOLUTIONS TO YOUR MOLDING PROBLEMS:

1 The world's most complete, standard line of hydraulic plastics molding equipment.

2 100 years of experience in building hydraulic machinery.

Only Watson-Stillman can offer you a complete, standard line of equipment that can meet almost every molding need—no matter what method, no matter what plastic material you want to use. And, in addition, Watson-Stillman gives you the benefit of their experience gained through 100 years in building hydraulic machinery. So to get modern production speed and efficiency, ease of operation and maintenance plus the cost advantages of standard design, specify W-S equipment.

The W-S line includes horizontal and vertical injection machines, transfer machines, compression presses, laboratory presses, automatic tableting machines, hobbing presses, record presses and general purpose presses.

Ask W-S for scientific advice in solving your molding problems, without obligation. Detailed information on all machines sent on request.

WATSON-STILLMAN

FACTORY AND MAIN OFFICE: ROSELLE, NEW JERSEY
BRANCH OFFICES: PHILADELPHIA, PA. • CHICAGO, ILL.

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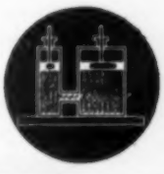
MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

3157

1848 • CENTENNIAL • 1948



W-S "COMPLETELINE"

Vertical Injection Machines.....1, 2 & 4 oz.
Horizontal Injection Machines.....8 to 80 oz.
Compression Molding Machines....50 to 1200 ton
Transfer Molding Machines.....30 to 1200 ton
Tableting Machines.....10 and 100 ton
Laboratory Presses.....10 to 200 ton
Hobbing & Die Sinking Presses....200 to 3000 ton
Preformers • Plasticizers • Laminating and Polishing Presses • Record Presses

The Right Move at the Right Time

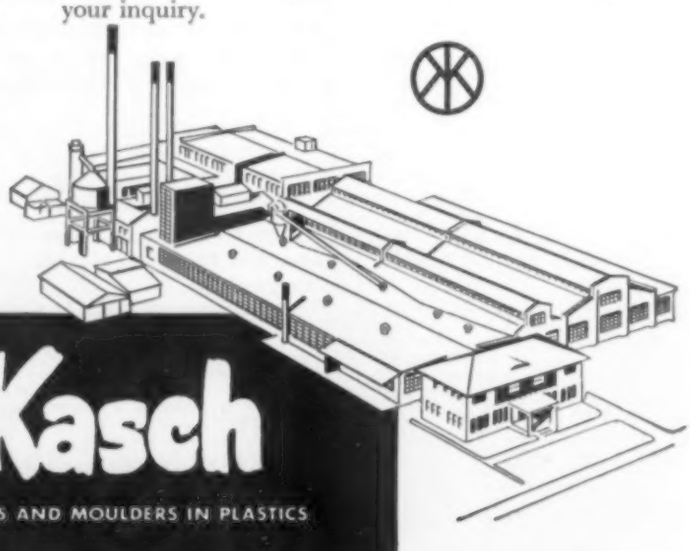
and PLASTICS MAKE PERFECT!

WHEN YOU make a play for all the benefits that Plastics offer—let us help you plan and execute your attack. An experienced moulder's knowledge means just as much in planning as it does in actual production. It will smooth out design and production kinks—possibly cut costs—and certainly ensure a better, sweeter-running job.

We'll take full responsibility for reproduction of your blueprints — quote a fair price on a job that will keep specified shipments of quality parts moving into your delivery docks at required dates. And with that quotation, we'll stake the 31-year-old Kurz-Kasch reputation for capability in plastics.

The Kurz-Kasch plant is large, modern and self-integrated for the design and production of any plastic part by compression, transfer or plunger moulding techniques. We're interested in your business — we'll send you a sales engineer at the drop of a hat — and we cordially invite your inquiry.

Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio
BRANCH SALES OFFICES: New York, *Lexington 2-6677* Chicago, *Harrison 5473* • Detroit, *Randolph 5214* Franklin, Pa., *Venango County 186* • Los Angeles, *Prospect 7503* • Dallas, *Lakeside 1022* • St. Louis, *Rosedale 3542* • Toronto, Canada, *Adelaide 1377.*
EXPORT OFFICES: 89 Broad Street, New York City, *Bowling Green 9-7751.*

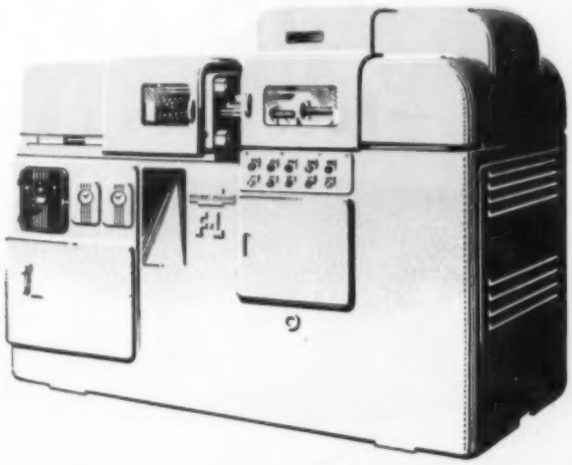


Kurz-Kasch

FOR OVER 31 YEARS PLANNERS AND MOULDERS IN PLASTICS

150 MORE SHOTS per day*

The new, unique FELLOWS-LEOMINSTER "Speed-Flo" Cylinder with the "Taper-Tite" Separator brings this extra plasticising capacity. A new balancing of heat distribution increases capacity, in pounds per hour, 10 to 14%. Your operator can speed up the output rate to give 124 to 177 additional shots per shift. Think what this means in the multiplied number of pieces—and in extra daily profits. A new bulletin of Fellows-Leominster "Speed-Flo" injection molding equipment is now available. Write: The Fellows Gear Shaper Company, Plastics Machine Division, Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Building, Detroit 2; 640 West Town Office Building, Chicago 12; 7706 Empire State Building, New York 1. New England Distributor: Leominster Tool Company, Leominster, Mass.



Fellows

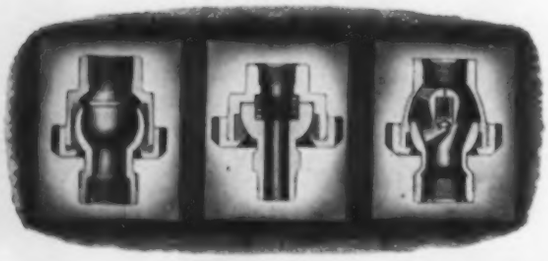
LEOMINSTER

injection molding equipment

**Based on an 8-hour day, 2 ounces per shot on the 1-B-2 machine*

TO ABSORB SHOCK

—Fuel Lines need Barco Flexible Joints



The battering impacts and shocks of vibration in mechanical operation are absorbed by Barco Flexible Joints. Providing for expansion and contraction, they keep pipes aligned, protect fluid-conveying systems against interruptions or breakdowns. In every branch of industry and transportation you will find Barco Joints at work, giving fuel line systems longer life, insuring steadier and more economical operation. Full details on request. Barco Manufacturing Company, 1809 Winnemac Avenue, Chicago 40, Illinois.

BARCO **FLEXIBLE JOINTS**

Not just a swivel joint ...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

In Canada: The Holden Co., Ltd., Montreal, Canada.

"MOVE IN EVERY DIRECTION"

Baby Book Bank, molded of acetate for Banthrico, Chicago

Something to Bank on

This bank can teach you a profitable lesson in plastics. While it was made to teach a child one of the dependable virtues, it also tells you about one of the most dependable virtues of the Elmer E. Mills Corporation . . . our imagineering* versatility. It is proof of the painstaking care and attention we give to injection molding and extrusion jobs from the simple to the highly complex.

You can always bank on this fact: A product molded by the Elmer E. Mills Corporation will be a brilliant example of the plastic molder's craftsmanship and scientific ingenuity.

Bring your next molding job to us. You will be more than pleased with the result.

Imagination and Engineering Skill

rite on your letterhead for e new Injection Molded and truded Plastics Catalog. Or, r detailed information about *, pipe, tubg and fittings, write for circlars containing data and strations.

*Trademark Reg.

ELMER E. MILLS CORPORATION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastocele, Fibestos, Lucite, Plexiglas, Nylon, Polystyrene, Styron, Lustron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Cerex, Forticel, *, Saran, and other Thermoplastic Materials.

153 WEST HURON STREET • CHICAGO 10, ILLINOIS

Strange fire-fighting equipment?

Strange . . . but *effective!* They're safety tools. They fight fires and explosions in many hazardous occupations.

What qualities make a metal suitable for safety tools in the plastic industry?

First . . . *freedom from combustible sparking* to reduce fire and explosion hazards. Next, *corrosion resistance* . . . ability to withstand the harmful action of plastics chemicals. Then, for long service life, *tensile strength, toughness, hardness.*

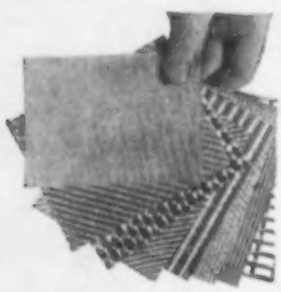
Each property you add to the list cuts down the number of usable metals. When you add: *no tendency to form dangerously unstable compounds while in contact with various explosives,* you eliminate all but "K"* Monel and "S"* Monel.

That's why Ampco Metal, Inc. of Milwaukee, Wisconsin, chose these two INCO Nickel Alloys for a new line of safety tools.

METAL PROBLEMS END *when you "discover" the* INCO *Nickel Alloys. These task metals of industry will help you fight rust, heat, corrosion, stress, and wear.*

Tell us your *problem. We'll be glad to help.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.



THESE ALSO STOP TROUBLE! INCO *Nickel Alloys are available in all forms. For example: screen cloth and filter cloth of Monel, Nickel and Inconel. Use them to replace troublesome fabric and cloth of less durable metal. Seams are readily brazed, soldered, or welded, and do not deteriorate in service!*

INCO Nickel Alloys

Monel • "K"* *Monel* • "S"* *Monel* • "R"* *Monel* • "KR"* *Monel*
Inconel • *Nickel* • "L"* *Nickel* • "Z"* *Nickel* *Reg. U. S. Pat. Off.

EMBLEM OF SERVICE

"Task Metals" for Industry

ENGINEERED TO YOUR NEEDS

MACOID MADE

DRY EXTRUDED PLASTICS

MACOID engineers are proud of their reputation for cost-saving, through the adaptation of extrusions like these to replace more costly materials.

You can be confident that a MACOID-MADE extrusion will conform to all your product's specifications.

It may mean important savings to you to finish the letter below. Write MACOID today.

YOUR LETTERHEAD

YOUR ADDRESS

Detroit Macoid Corporation
12346 Cloverdale
Detroit 4, Michigan

Dear Sirs:

Tell us how the following (described or illustrated herewith) can be made to our advantage by your dry plastics extrusion process.

MACOID originated dry process plastics extrusion in 1936 for the automotive industry.

ALSO INJECTION MOLDING

TEXAS CITY RESUMES

Steady Polystyrene production assured—Styrene monomer is in production again at Monsanto's Texas City plant . . . a symbol of the determination of the townspeople to build a greater Texas City . . . a new emphasis on Monsanto's leading position as a polystyrene supplier.

Almost a year to the day after the plant was destroyed by a nearby ship explosion, some units of the rebuilt plant got underway. Today, Monsanto's prominent position in the production of polystyrene is restored, with production facilities equal to the capacity of the plant destroyed in April, 1947.

ES STYRENE PRODUCTION

How full scale Monomer production affects Plastics and other markets

Monsanto's resumption of large scale production of styrene monomer means a continued and reliable flow of polystyrene . . . a stimulation to the entire plastics industry from the smallest molding plant to the largest materials supplier. Styrene monomer . . . base for Monsanto's versatile Lustron and Lustrex . . . is a large factor in the economics of the plastics industry. Other industries, too, have important uses for polystyrene . . . and styrene monomer. Check the benefits Monsanto's styrene monomer can give you in these categories:

USES OF EMULSIONS AND SOLUTIONS Solutions of polystyrene can be used as a laminating or impregnating resin with cloth, paper and with other fillers. Polystyrene emulsions have markets as adhesives, insulating impregnants, bonding materials and coating materials.

FOR THE RUBBER INDUSTRY Copolymers of styrene and butadiene (GR-S) are widely used in the rubber industry; Texas City was the first plant constructed for the government to produce wartime synthetic rubber. During the war, this Monsanto-built and operated plant produced one-fourth of all the styrene used by the rubber reserve program.

FOR PURIFICATION OF LIQUIDS Styrene monomer can be used to prepare cation exchange resins for water purification, and for the purification of other liquids such as sugar syrups.

FOR NEW DESIGNS . . . NEW MATERIALS Polystyrene presents a broad base for the design of many industrial and consumer products . . . and the base constantly widens as new uses are found and new material improvements are made.

In these days of critical materials shortages . . . and in tightening cost competition . . . economical, easy-to-mold polystyrene solves many materials problems from farm and factory equipment to decorative domestic appliances.

PHYSICAL PROPERTIES	
Monsanto styrene monomer LM-100 is a water white liquid monomer of polymerization or resin intermediate grade.	
Appearance	clear
Color, maximum, APHA platinum-cobalt scale	15
Specific gravity @ 15.5°C.	0.91
Viscosity @ 25°C., maximum centipoises	0.80
Purity, minimum, %	99.3
Aldehydes, maximum % (as benzaldehyde)	0.015
Peroxides, maximum % (as hydrogen peroxide)	0.010
Chlorine compounds, maximum %	0.005
Sulfur, total maximum %	0.010
Phenyl acetylene, maximum %	0.015
Polymer maximum %	0.20
Solubility of polymer in benzene	complete
Inhibitor ppm (as tertiary butyl catechol)	10-15

Technical Council helps solve your product problems . . .

A council of experts . . . seasoned for years in the plastics industry . . . is at your service to solve product problems whether in materials production or merchandising. If you are designing a new material, let Monsanto bring the whole range of plastics physical properties to focus on your requirements. The same experts will help you find better materials at lower costs. The coupon below will bring you complete information. Lustron: Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY, PLASTICS DIVISION
DEPT. MPLP6, SPRINGFIELD 2, MASS.

Please send me information on the Monsanto Family of Plastics ☐, *on the work of the Monsanto Technical Council* ☐, *Special Bulletin on Monsanto's Styrene Monomer* ☐

NAME TITLE

COMPANY

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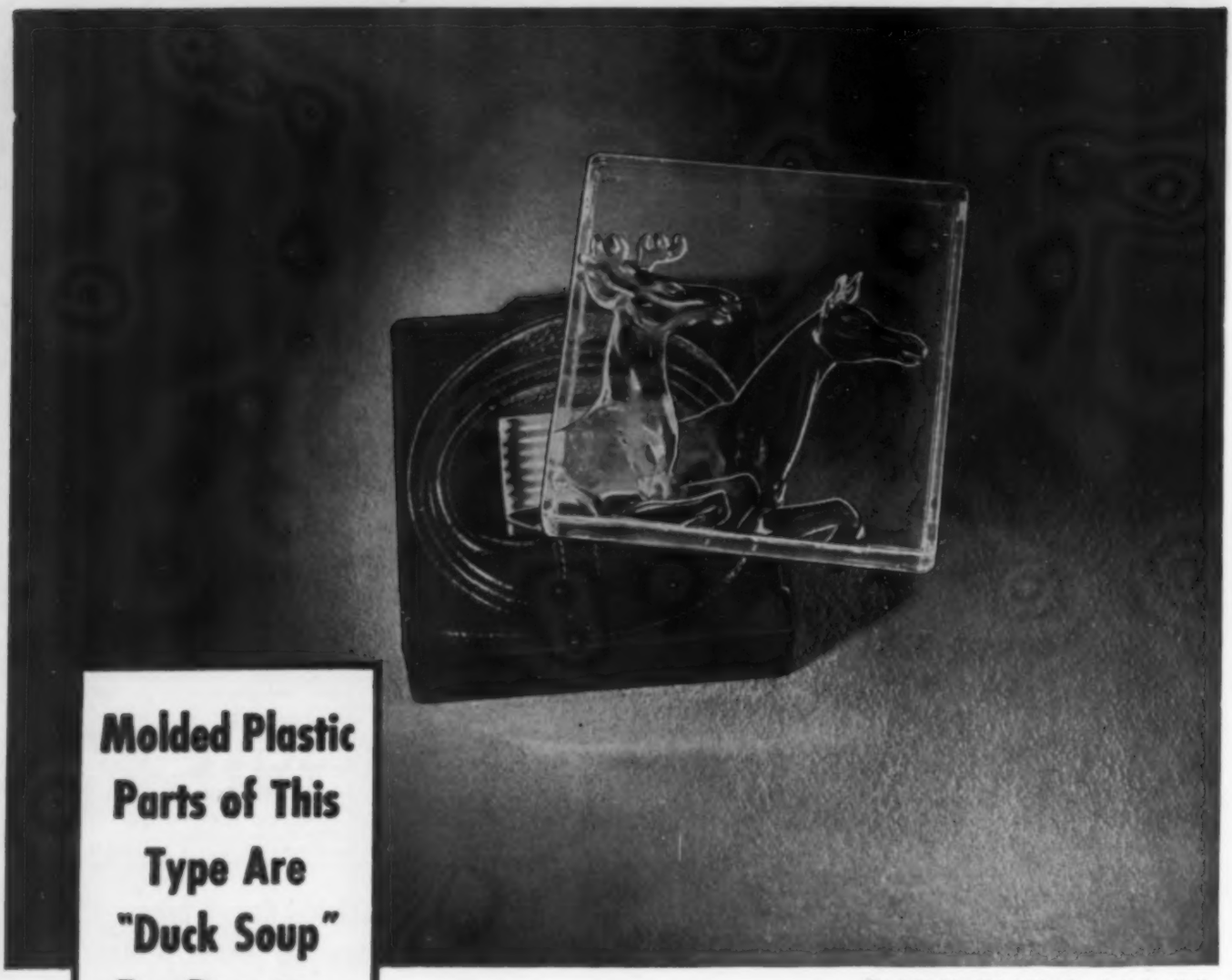
SERVING INDUSTRY . . . WHICH SERVES MANKIND



Molded Plastic Parts of This Type Are "Duck Soup" For Boonton

Box Molded for Hickok Mfg. Co., Rochester, N. Y.

Have you a Production Problem that Molded Plastics might solve?

IT'S easy to see through this fine packaging idea. An excellent product, beautifully packaged in a molded plastic box—a decorative cigarette box for later. Look again. Maybe you'll see a packaging idea for *your* product that will more than pay off in increased sales! Or, perhaps your product doesn't require packaging, but needs a housing or part. Plastic molding is our business at Boonton. We're equipped to mold the parts and products you need in medium or large runs—from the *right* raw plastic material —by the 4 major molding processes. Try this:

Many of our customers have saved substantial sums of money by asking our engineers to talk to their engineers before their products reached the purchasing stage. They've been amazed and pleased at the ways we've come up with design and production suggestions that shaved costs all the way around. Perhaps we can do the same for you. Maybe we've learned something in our 25 years of molding plastics that can be helpful to you. We'll be glad to share this experience with you. Write or phone The Boonton Molding Company, Boonton 3, N. J., Boonton 8-2020.

SEND US YOUR BLUEPRINTS OR SAMPLES We'll tell you whether the parts you want can be plastic molded, and if they can, how much it will cost. Be sure to include full data on conditions of application or use, initial quantities needed, annual requirements, and delivery date.

Boonton

MOLDERS OF MOST PLASTICS BY MOST METHODS

Get out from behind!

THERE isn't much you can do about lowering material and labor costs.

Your overhead remains fixed.

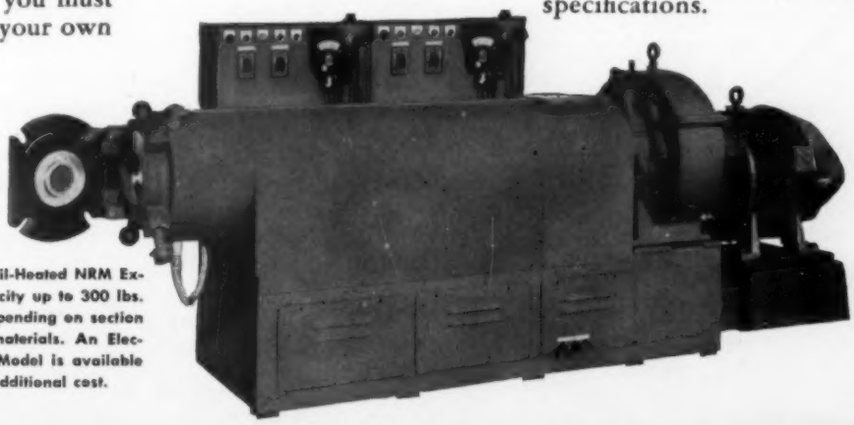
Yet to become more competitive, to meet industry's needs, to decrease rather than increase prices . . . you must find a way to lower your own production costs.

If your production calls for extruding larger cross sections in big volume—up to 300 lbs. per hr.—NRM's improved, oil-heated 4½" extruder may well be your answer.

If high pounds per hour output of materials requiring up to 475°-500°F. extruding temperatures is important to your type of production, don't hesitate to get specifications, performance data and costs on this big NRM extruder.

Design and engineering changes have substantially improved this unit's proven performance and output capacity. These changes have also resulted in lowering our manufacturing costs. These savings are, of course, passed along to you.

Write today for complete information and up-to-date specifications.



The 4½" Oil-Heated NRM Extruder, capacity up to 300 lbs. per hour depending on section sizes and materials. An Electric Heated Model is available at a slight additional cost.

NRM

NATIONAL RUBBER MACHINERY CO.

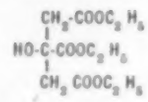
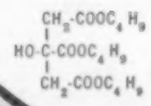
General Offices: AKRON 8, OHIO

California Representative: Sam Kipp, P. O. Box 441, Pasadena 18, Calif.

Plastics MACHINERY DIVISION

EXPORT DISTRIBUTORS: OMNI PRODUCTS CORPORATION, 460 FOURTH AVE., NEW YORK 16, N. Y.

WHERE YOU CAN BENEFIT BY PFIZER DEVELOPMENT

Product	Plasticizer for . . .	Characteristics
PFIZER TRIETHYL CITRATE 	. . . cellulose acetate . . . cellulose acetate butyrate . . . ethylcellulose . . . nitrocellulose . . . vinyl resins . . . other cellulose esters & ethers . . . other types of plastics & resins . . . phenolic resins	Water white Very low solubility in oils Resistant to discoloration by light Excellent compatibility with most resins Particularly useful in film-forming materials to be used in coating products coming in contact with oil and grease
PFIZER TRIBUTYL CITRATE 	. . . nitrocellulose . . . ethylcellulose . . . vinyl resins . . . cellulose acetate butyrate . . . cellulose acetate . . . phenolic resins . . . other cellulose esters & ethers . . . other types of plastics & resins	Water white Low volatility Water resistant Resistant to discoloration by light Good compatibility with most resins Particularly useful in lacquers

Other Pfizer plasticizers among the esters of citric acid include acetyl triethyl citrate and acetyl tributyl citrate. For further details on these or any other Pfizer products serving the plastics field, please address Chas. Pfizer & Co., Inc., 81 Maiden Lane, New York 7, N. Y.; 444 West Grand Ave., Chicago 10, Ill.; 605 Third Street, San Francisco 7, Calif.

PFIZER

Manufacturing Chemists Since 1849

6669

Important Selling Point FOR SALE

A lot of people who are potential customers of yours will be looking for this tag from now on.

Six full-page, 4-color *Resproid* advertisements in Good Housekeeping magazine—starting this month—are telling over 5,500,000 of them what it means on cottage sets, shower curtains, waterproof garments, handbags, luggage, aprons, ladies' belts, furniture upholstery—any of the hundred-and-one things *Resproid* makes prettier and more practical.

Telling them that every item carrying this tag is as durable as it is lovely. That it is made of a modern material that will resist cracking, fading, scuffing and abrasion—perspiration, most acids, alcohol, oil, alkalies and grease. That it can be wiped clean as new in seconds with just a damp cloth.

That means this *Resproid* tag is an important extra selling point on anything you make. You're missing a good bet if you don't use it. Respro Inc., Cranston 10, R. I.

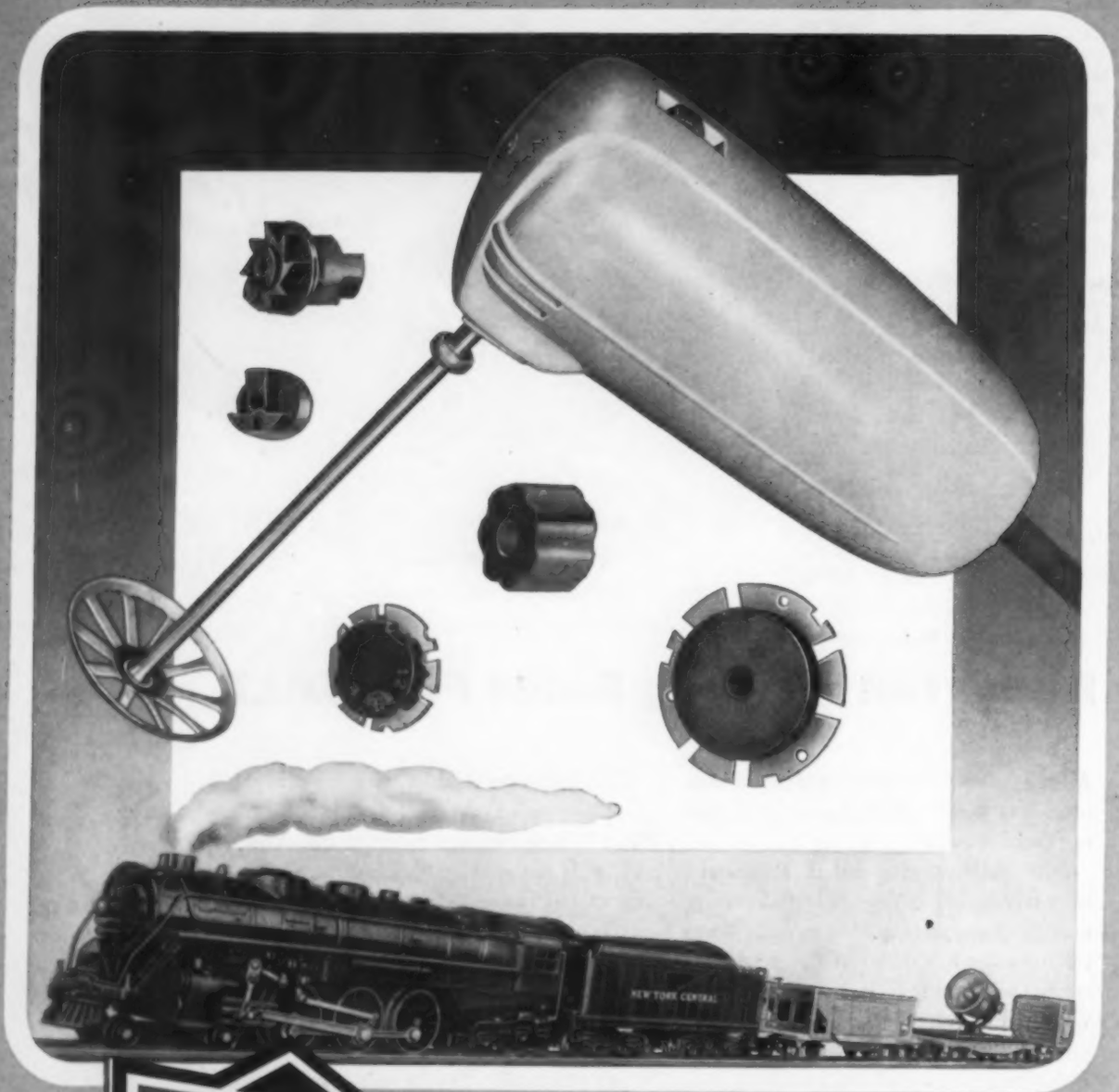
Guaranteed by Good Housekeeping

Resproid

TRADE MARK REG. U. S. PAT. OFF.

Resproid is also made in a new *Fire-Resistant* type. Use this special yellow and black tag carrying the words "Resproid—Fire-Resistant" to identify your products made of this material.

ANOTHER SUCCESSFUL SWITCH TO PLASTICS



SHAW

SHAW INSULATOR COMPANY

MOLDERS QUALITY MARK ON MOLDED PLASTICS SINCE 1892

160 COIT STREET IRVINGTON 11, N. J.

The small commutators used in motors which power A. C. Gilbert's outstanding electric trains and appliances are fairly tricky jobs for plastics. Yet Gilbert could go to Shaw for these diminutive parts, knowing that the desired combination of precision and price would be obtained.

Transfer molding, a technique developed by Shaw, offered the ideal solution for producing the commutators complete, with inserts imbedded in the molded pieces. Skilled engineering, the right materials, a fast molding cycle and large mold output assured a practical and economical switch to plastics. Shaw also molded the handsome, chip-proof Whirlbeater housing.

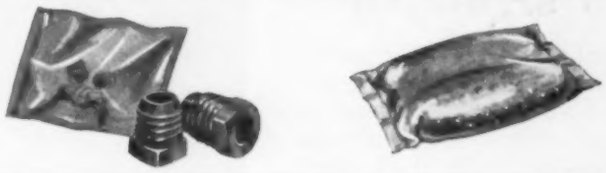
"Accent on Efficiency!" is a bulletin describing Shaw's laboratory facilities. Please write for it.

IMPORTANT FACTS TO KEEP HANDY

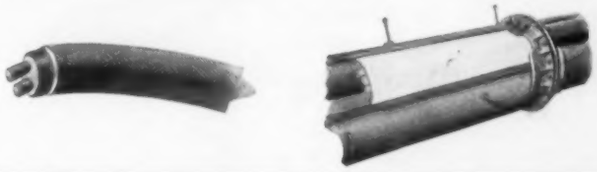
PLAX POLYETHYLENE SHEET AND FILM

STRETCHES WITHOUT TEARING
Even at Sub-zero Temperatures
(Elongation, 77°F, 300-500%)

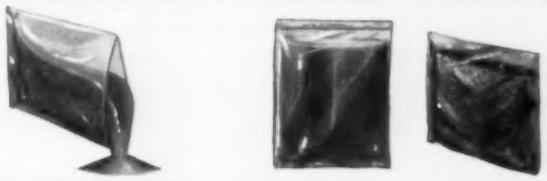
WATER-VAPOR RESISTANT
(Water absorption, 24 hrs., 0.01%)



HIGH DIELECTRIC STRENGTH
(Dielectric constant of 2.3 at frequencies of 10^2 and 10^6)



CHEMICALLY-RESISTANT
(Not affected by acids, alcohols)



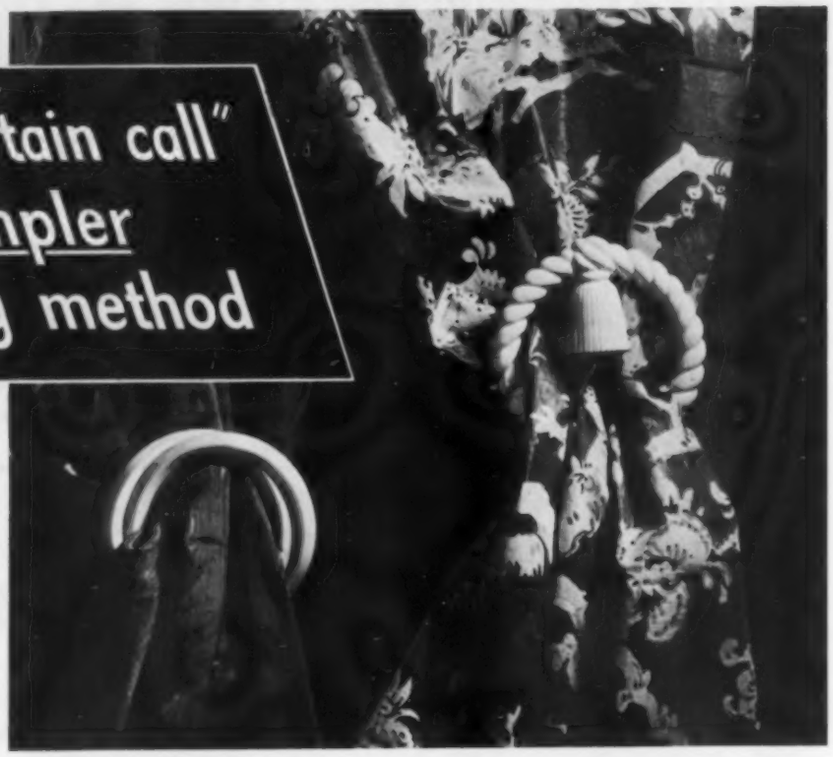
CHEMICALLY-INERT
(Non-toxic, odorless and tasteless)

ABOVE ARE A FEW of the many desirable characteristics that make for apparently limitless application possibilities. The possible uses of Plax polyethylene sheet and film have been barely explored. As a leading supplier of plastics in many forms, Plax can be of real help in exploring the application of this and other materials to your product. Please write Plax for complete details.

P. O. BOX 1019 ★ HARTFORD 1, CONNECTICUT
In Canada — Canadian Industries, Ltd., Montreal

COMMON SENSE ASSEMBLY ENGINEERING...

Leads to a "curtain call" for the simpler P-K fastening method



Saves time... adds strength

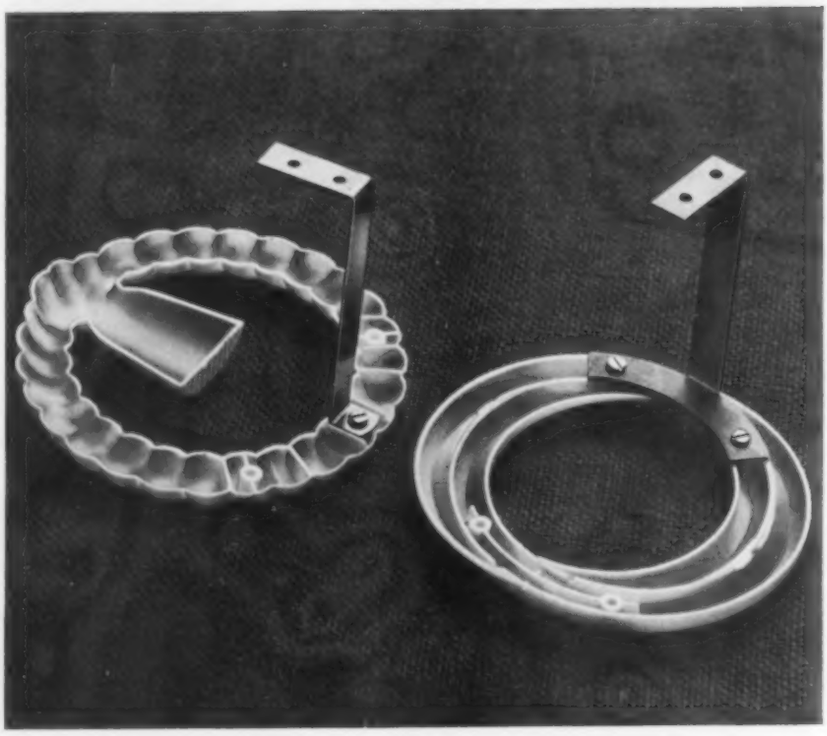
Werner Molded Plastics Co., manufacturers of these handsome drapery rings, wanted a fastener that assured a fast, simple assembly to keep costs down, avoid spoilage. And they needed plenty of strength, too, because the rings have to stand the strain of housewives' fussing and fitting — and have to hold heavy drapes in place.

P-K Type "Z" Self-tapping Screws were chosen as the logical answer to all requirements. Because they form their own threads as they are driven, they eliminate the need for tapping, or for costly, mold-slowing inserts. They provide strength where it is most needed, and they can be removed and reinserted without sacrificing holding power.

It will pay you to apply similar common sense engineering to your assembly problems. Question every fastening. Find out if you can reduce operations, avoid breakage, add strength, or simplify product design with the simpler P-K fastening method.

Call in a P-K Assembly Engineer. In 7 out of 10 cases, he can demonstrate that P-K Self-tapping Screws will save up to 50% in assembly work-hours. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

Sold Only Through Accredited Distributors



P-K® The Original

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON SELF-TAPPING SCREWS

OTHER PARKER-KALON PRODUCTS COLD-FORGED SOCKET SCREWS • HARDENED SCREWNAILS AND MASONRY NAILS • SHUR-GRIP FILE AND SOLDER IRON HANDLES • METAL PUNCHES • DAMPER REGULATORS AND ACCESSORIES

PYRO NEVER MISSES . . .

When you bring your custom molding to Pyro, you are assured of direct, to-the-point advice. Whether your job is in the first stages of conception or ready to be molded from finished dies, Pyro can recommend the most economical way of putting a sound, colorful, well-molded product on the market. In all phases of plastic production in all fields, Pyro gives you the best in injection molding.

Pyro

PLASTICS CORPORATION

691 CHESTNUT STREET AT ROUTE 29
UNION, UNION COUNTY, NEW JERSEY

Bringing up germ-free rats...

calls for seamless gloves made by the exclusive Anode process

A SINGLE-PIECE, arm-length glove is an important advance in rearing germ-free rats—a bacteriological study being made in the Laboratories of Bacteriology at the University of Notre Dame which may lead to new knowledge in the sciences of nutrition and disease.

Previously a two-piece rubber glove had been used. However, the Anode dipping process made possible this intricate and improved type glove, thus helping laboratory workers keep rats germ-free for as many as 300 days at a time! Failure of the glove at any time during the observation periods might have caused the loss of thousands of man-hours of patient care and study.

Yet intricate shapes and rigid specifications are nothing new in the demands made upon American Anode latices and mixes, or the manner in which they are employed. Meteorological balloons, catheters, high-altitude oxygen masks with ducts and metal inserts have also been made in one piece—have also performed with complete satisfaction and long life.

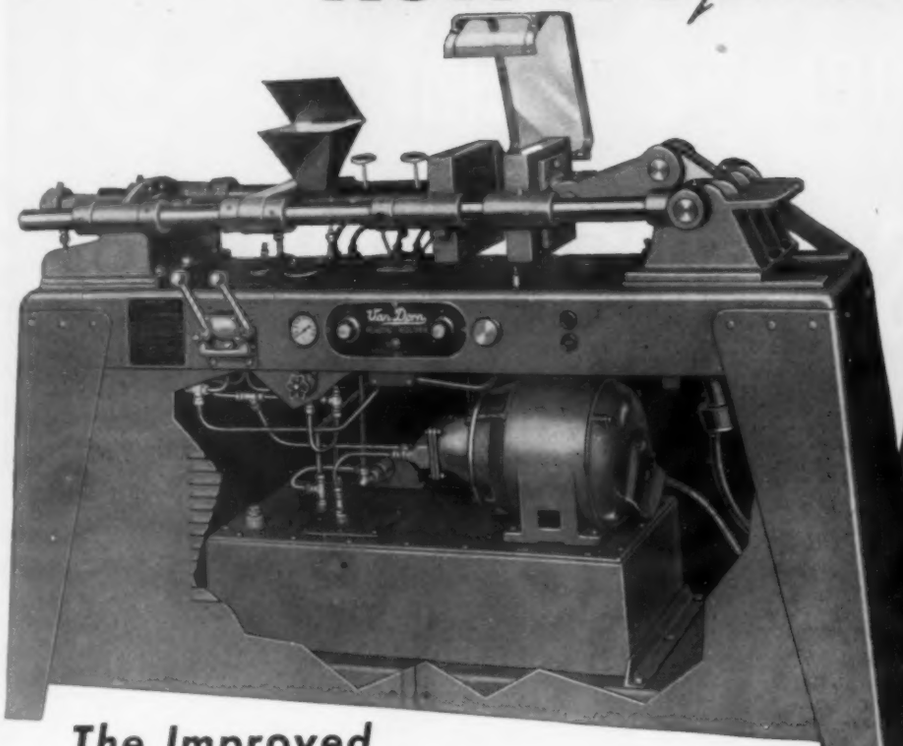
Development is the most important of the jobs of American Anode, and many's the task once thought impossible that the Anode process has solved very well. Latices and compounded mixes of GEON, HYCAR, neoprene, crude and GR-S are available. For more information about these modern materials—and proper methods of using them—please write Dept. AF-3, American Anode, Inc., 60 Cherry St., Akron, O

AMERICAN ANODE

CRUDE AND AMERICAN RUBBER LATICES, WATER CEMENTS AND SUSPENSIONS

Always Outstanding

NOW IT'S EVEN BETTER!



Spreader added to heating cylinder cuts heating cycles up to 50%.

Hard Chrome Plating of interior of cylinder cuts resistance to flow of materials, protects against corrosive compounds.

New Relief Valve—set at 1500 P.S.I.—insures maximum clamping pressure always, permits separate adjustment of injection pressure.

New Needle Valve increases gage life, by allowing gage to be shut off except for periodic checks on pressure.

SAME LOW PRICE !!

The Improved
VAN DORN Plastic Press

With the addition of these four new features, this Van Dorn Press is *unequalled* in the 1 oz.-capacity class for molding practically all thermoplastics including nylon. This remarkably economical press—

Costs under $2000

Operates 8 hours for under a dollar

Uses less expensive molds

Can be set up by one man in 20 minutes

This Van Dorn Injection Press is unexcelled for profitable production of small parts, and "pilot" or experimental runs on bigger jobs.

We make mold bases for Van Dorn Presses.

THE Van Dorn IRON WORKS CO.
2687 EAST 79th STREET • CLEVELAND 4, OHIO

FREE BULLETIN
tells all the facts.
Write for it.

Here's one place where a dollar BUYS MORE TODAY than in 1939!

When you pay almost double the 1939 price for a ton of coal, you're still only getting 2,000 pounds of coal. No matter how you burn it, you won't average more than 12,500 b.t.u.'s per pound—same as in 1939. And that goes for almost everything else that has gone up in price—you're paying more today, but you get no compensating increase in value.

Compare the cost of your advertising in MODERN PLASTICS on the same basis, and what do you find?

Even with an increase in rates, your advertising dollar, in MODERN PLASTICS, actually buys more today—not less—than in 1939. Today you receive 223% more circulation —18,666 for only $325 per page, as compared with a circulation of 9,079 for $185 per page in 1939, (net paid ABC—6 time rate). The cost per thousand circulation has decreased from $20.37 per thousand in 1939 to $17.41 in 1948.

The actual unit sales of machinery, equipment and supplies—the purchasing power, the dollar volume—are all much greater than in 1939. That means that your advertising in MODERN PLASTICS is not only covering a broader area, but a much more fertile one.

It has been estimated that by the end of 1947 the total potential demand for plastics raw materials will have increased 4400% over 1939. From 1939 to 1947 the estimated plant investments in plastics materials and production facilities increased from $50 million to over $300 million (including certain synthetic resins). This means that the plastics market today is over six times as fertile as it was in 1939.

Never before in the history of MODERN PLASTICS have we offered greater value for the advertising dollar than we do today. But the biggest gain belongs to the advertiser who understands how to use the advertising pages of MODERN PLASTICS and the simple arithmetic of reaching a net paid circulation of 18,666 every month for only $17.70 per thousand. And if you consider an average of approximately three additional pass-on readers per copy, your actual circulation cost is less than $5 per thousand.

ABC

ABP

MODERN PLASTICS

A BRESKIN PUBLICATION

122 EAST 42nd STREET • NEW YORK 17, N. Y.

PHTHALIC ANHYDRIDE

Form		Clean, white flakes
Color	Molten	55 Max. (Hazen)
	Solid	Pure White
Solidifying Point		130.5° C Min.
Odor		Slight, characteristic
Insoluble in Water		0.01% Max.
Maleic Anhydride		0.40% Max.
Foam Time		18 minutes Min.

Containers: 5-ply Paper Bags—80 lb. net weight.

Barrett* Phthalic Anhydride is of uniform and unsurpassed quality—pure white, free-flowing flakes containing a minimum of fines.

Carefully controlled for freedom from materials which cause premature gelling and excessive foaming, Barrett* Phthalic Anhydride is widely used in the production of alkyd resins for metal finishes, enamels, paints and varnishes.

Phthalic Anhydride is a basic material in the production of phthalic esters for vinyl resins used in the manufacture of upholstery, handbags, luggage, floor tile, raincoats, shower curtains, etc.

The dyestuff industry finds Phthalic Anhydride essential as a basic material in the manufacture of anthraquinone, dyes, phenolphthalein and other synthetic organic chemicals.

Send for copy of Barrett's 48-page illustrated booklet, "Phthalic Anhydride."

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, Que.

*Reg. U. S. Pat. Off.

Torsion Stiffness Testing Machine FOR PLASTICS

Used for determining the stiffness in torsion of plastics over a wide temperature range, this research and production apparatus is particularly adaptable for low temperature testing. This tester was developed by Dr. R. F. Clash, Jr., and Mr. R. M. Berg of the Bakelite Corporation*.

The test specimens are immersed in a circulated heat transfer medium and torque loads are applied from 0.1 to 0.5 inch-pounds. Angular twist is measured in degrees on the torsion head.

- **Modern New Design—Bench Type**
- **"Finger Tip" Controls**
- **Vacuum Flask—Easily inserted and removed**
- **Stirrer—Positive Variable Speed Drive**
- **Automatic Defrosting Unit**

The Torsion Stiffness Testing Machine is a new member of the Olsen line of testing machines for the testing of plastics. You are invited to write for full information.

* Stiffness and Brittleness of Nonrigid Vinyl Chloride-Acetate Resin Compounds. Issued July, 1944. Modern Plastics

TINIUS OLSEN

Testing & Balancing Machines

TINIUS OLSEN TESTING MACHINE CO.
580 North Twelfth Street, Philadelphia 23, Pa.

Representatives:
Pacific Scientific Co., Los Angeles, San Francisco, Seattle • Mine Smelter Supply Co., Denver, Colo.

● In our world of tomorrow that soon will be today, beauty plays a new and leading role. For modern designers have found beauty has in it the essence of utility. Auto-Lite's great Bay Manufacturing Division reflects the importance of this new trend. Here under one roof are the technical skills and production capacity for a new art rendered in plastics including brilliantly colored elastomeric plastics, decorated metals and metal-plastic combinations. The artistic skill of Auto-Lite's Art and Style Division is available on matters of style and development.

THE ELECTRIC AUTO-LITE COMPANY

Bay Manufacturing Division

Detroit 2, Michigan — Bay City, Michigan

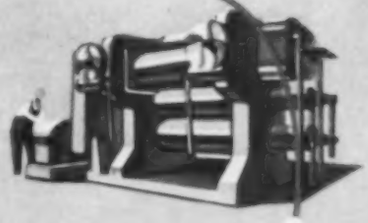
Auto-Lite

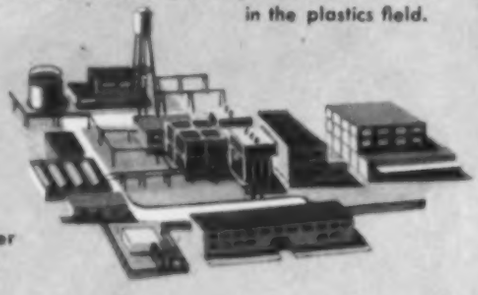
plastics and metals

AUTO-LITE MEANS PRECISION MANUFACTURING

Tune in the Dick Haymes Show for Auto-Lite, Thursday, 9:00 P.M.—E.T. on CBS.

MODERN PLANT!
New Marvinol plant, now in production, contains latest equipment to assure efficient operation, uniform product. No division of The Glenn L. Martin Company compounds or fabricates in the plastics field.



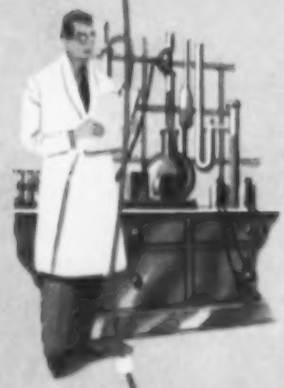


WIDE TEMPERATURE RANGE!
Products made from Marvinol resins show less heat deformation than other resins . . . offer positive advantages in low temperature flexibility.

UNUSUAL VERSATILITY!
Easy to process, Marvinol resin may be calendered, extruded, injection molded, used in non-aqueous dispersions, formulated as unplasticized rigids.

these unique advantages make **MARVINOL® RESINS** *a must!*

TECHNICAL COOPERATION!
Expert sales engineers and fully-equipped customer service laboratory are available. Write on your company letterhead to: Chemicals Division, The Glenn L. Martin Co., Baltimore 3, Maryland.



UNSURPASSED STABILITY!
A polyvinyl chloride-type resin, of high molecular weight, Marvinol offers superior resistance to heat, light and other normally destructive factors.

MANY OTHER ADVANTAGES!
Unusual "dryness" . . . exceptional toughness and long life . . . may be tasteless, odorless . . . easily, quickly cleaned . . . can give crystal-clear transparency, brilliant or delicate colors.

BROAD EXPERIENCE!
A leader in research, Martin introduced the first plastic nose section for aircraft in 1921 . . . developed the first leak-proof flexible fuel tank, the Mareng cell . . . used as many as 400 plastic parts in one plane.

Martin® Marvinol

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF

THE GLENN L. MARTIN COMPANY • AN INTERNATIONAL INSTITUTION

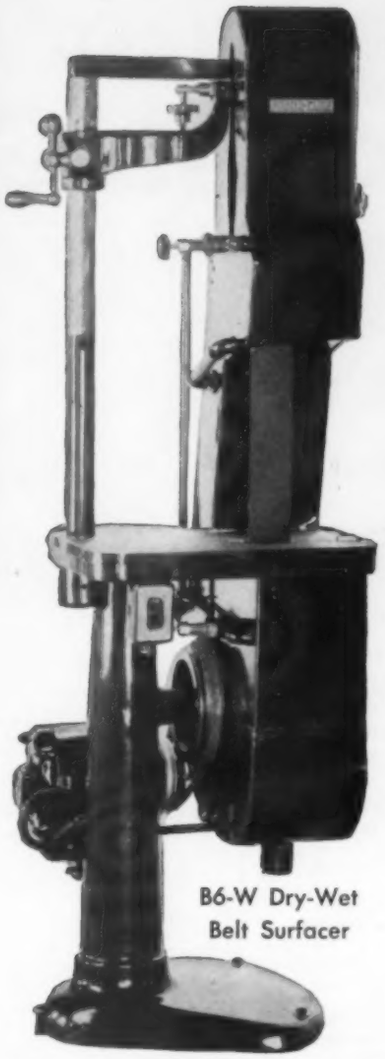
"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"

5 TO 25 TIMES FASTER!

Porter-Cable

WET-DRY

Belt Surfacer



B6-W Dry-Wet
Belt Surfacer

TAKES OFF FLASHINGS

REMOVES GATES

FINISHES ROUGH SPOTS

SMOOTHS IMPERFECTIONS

GIVES OVER-ALL FINISH

FIND OUT how Porter-Cable Wet-Dry Belt Surfacers will *increase YOUR production . . . improve quality of work at lower cost.* Mail this coupon today.

Eliminates flow, dust, distortion and discoloration . . .

Here's a finishing method that makes other methods seem outmoded. The Porter-Cable Wet-Dry Belt Surfacer is turning out work at a pace that often seems incredible to production men . . . until they see the B6-W in action on all kinds of plastics. It delivers speed with accuracy . . . operates at low cost . . . eliminates flow, discoloration, dust . . . and it's safe.

***Versatile* B6-W** It's taking over many surfacing jobs from both bench and machine. It works on curved and irregular surfaces as well as flats. Its flexible belt follows contours, reaches hard-to-get-at places. It removes gates, flashings, parting lines . . . finishes rough spots, smoothes molded defects . . . machines true flats on bosses, abutting rims and faces. Operates on variety of backing plates for various jobs. With simple platen behind flexible belt, the B6-W finishes identical surfaces *uniformly* on repeated operations.

PORTER-CABLE
MACHINE COMPANY

1606-6 N. Salina St., Syracuse, N. Y.

Porter-Cable Machine Co.
1606-6 N. Salina St., Syracuse 8, N. Y.

Please send me without charge your booklet "Abrasive Belt Surfacing".

My name .....

Company .....

Address .....

City ..... Zone ..... State .....

INDUSTRY—RECOGNIZED
HOME TRAINING IN PLASTICS

PLASTICS INSTITUTE CURRICULUM
Embraces Comprehensive Coverage of Following Subjects

- Introduction to Plastics
- Origin and Role of the Plastics Industry
- Formation of Phenolic Plastics, Part I
- Formation of Phenolic Plastics, Part II
- Laminated Phenolic Resins
- Urea and Melamine Resins and Their Characteristics
- Cellulose Plastics, Part I
- Cellulose Plastics, Part II
- Acrylic and Polystyrene Resins
- Polyvinyl Resins and Their Characteristics, Part I
- Polyvinyl Resins and Their Characteristics, Part II
- Miscellaneous Resins, Polymides
- Synthetic Rubbers and Rubber-like Materials
- Utilization of Farm Products and Vegetable By-Products
- Physical Properties of Plastics, Part I
- Optical Properties of Plastics Materials
- Molding of Plastics—Preparatory Measures
- Compression and Transfer Molding
- Compression Molding and Equipment
- Injection Molding—Part I
- Injection Molding—Part II
- Extruded Plastics and Their Applications
- Developing Heat and Pressure for Molding
- Design of Compression Molds
- Design of Transfer and Injection Molds
- Design of Molded Plastics Parts—Part I
- Design of Molded Plastics Parts—Part II
- Cold Molding of Plastics
- Laminating of Plastic Materials
- Resin Bonded Wood Veneer
- Low Pressure Laminating
- Machining of Plastics—Part I
- Machining of Plastics—Part II
- Casting of Plastic Materials

Home Study and Resident School courses approved for Veteran training under G.I. Bill.

Many men and women engaged in some branch of the Plastics Industry have availed themselves of the opportunity to advance in their present jobs and prepare for better ones, through Plastics Institute's Home Study Course. Home Study and Resident School graduates are successfully employed in all branches of the industry. **Why not suggest this training to members of your organization?** MP-68

Plastics INDUSTRIES TECHNICAL INSTITUTE

Francis A. Gudger, *President* · John Delmonte, *Technical Director*

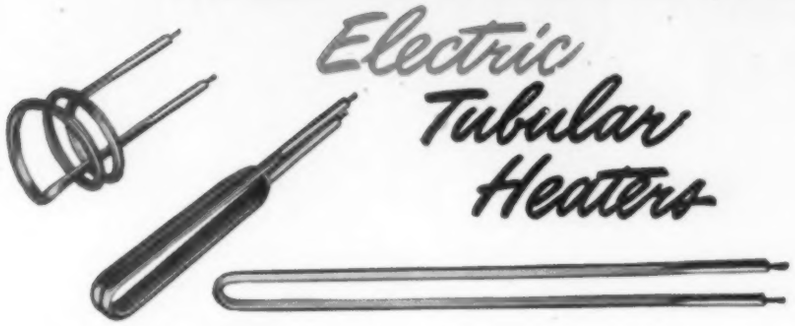
NEW YORK—31-28 Queens Blvd., Long Island City • CHICAGO—3810 N. Broadway
LOS ANGELES—1601 South Western Ave.

HEAT

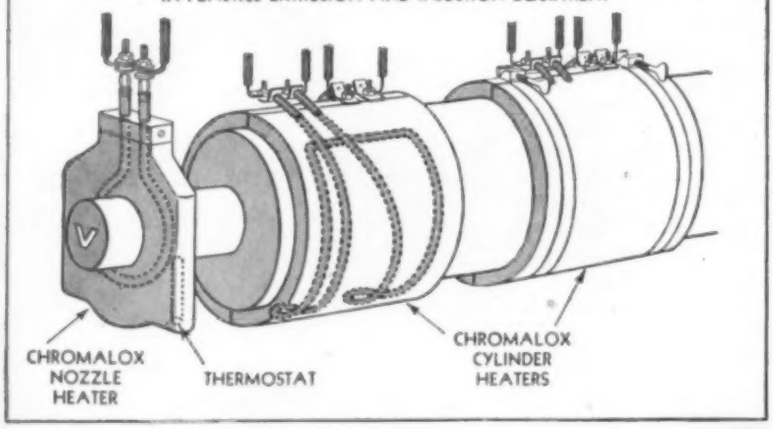
curved to fit your needs!

Chromalox

Electric Tubular Heaters



CHROMALOX ELECTRIC TUBULAR HEATERS CAST INTO ALUMINUM FOR USE IN PLASTICS EXTRUSION AND INJECTION EQUIPMENT



The above is only one example of the many types of applications easily obtained with CHROMALOX *Electric* Tubular Heaters. These heaters can be bent and formed for heating processing equipment, tanks, kettles, dies, platens and irregular surfaces.

Straight Tubular Units are used for convection or radiant heaters in ovens, platens and other high temperature equipment. Accurate temperature controls, with thermostats, guard against excessive processing temperatures.

CHROMALOX Application Engineers will gladly work with you on your heating problems.

Guide to CHROMALOX *Electric Heat* applications

Check this List

- Air Heaters
- Annealing Ovens
- Armature Heaters
- Asphalt Melting
- Babbitt Melting
- Baking Ovens
- Barrel Heaters
- Branding
- Brooders & Hatchers
- Can Soldering
- Cast Heating
- Cleaning Tanks
- Coating Tanks
- Core Baking
- Degreasers
- Dehydrating
- Die Heating
- Distilling
- Dryers
- Dropping Resistors
- Drum Heating
- Drying Ovens
- Duct Heaters
- Electroplating
- Embossing Dies
- Film Dryers
- Foundry Molds
- Fuel Oil Preheating
- Galvanizing
- Gas Heating
- Glue Cookers
- Glue Pots
- Glue Setting
- Hair Dryers
- Heat Sealers
- Hot Plates
- Humidity Control
- Infra Red Heating
- Ink Dryers
- Labeling Adhesives
- Lacquer Dryers
- Lens Cementing
- Matrix Presses
- Melting Pots
- Mold Heating
- Molten Salt Baths
- Oil Baths
- Oven Heaters
- Package Sealers
- Paint Dryers
- Pipe Heating
- Pitch Pots
- Plastic Extruders
- Platen Heaters
- Plating Baths
- Preform Heating
- Print Drying
- Process Air
- Process Kettles
- Radiant Heating
- Roll Heaters
- Room Heaters
- Sealing Equipment
- Soaking Tanks
- Soldering Irons
- Space Heaters
- Steam Generators
- Steam Superheaters
- Sterilizers
- Tempering Baths
- Tinning Pots
- Tire Recapping
- Varnish Drying
- Volatile Fluid Heating
- Vulcanizers
- Water Heaters
- Wax Melting

and Hundreds of other Applications throughout Industry

GET THIS BOOKLET

It is loaded with practical ideas which will save you time, money and labor in all types of industrial heating applications.

CHROMALOX

Electric Heat at its Best

ED'WIN L. WIEGAND COMPANY • 7503 THOMAS BLVD. • PITTSBURGH, PA.

LURIA INDUSTRIAL BUILDINGS

NOW IN PRODUCTION

Luria offers a complete line of Standard Buildings specifically planned to be adaptable for all industrial requirements. Several basic types in a wide range of sizes can be used individually or in a variety of combinations.

Luria buildings are permanent structures fabricated from heavy structural steel and designed to comply with the latest building codes. A choice in the use of collateral materials and the location and type of doors and windows increases the utility and allows complete freedom in architectural treatment.

BASIC UNIT WIDTHS 40′ TO 100′ CLEAR SPAN
LENGTH ADJUSTABLE IN INCREMENTS OF 20′
CLEARANCE AT EAVES 12′ TO 20′

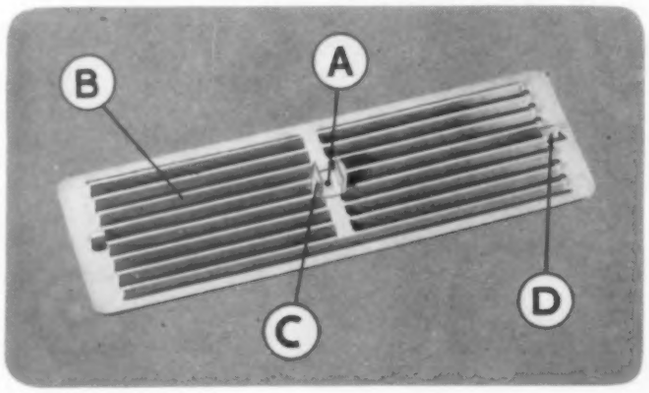
ADAPTATIONS OF STANDARD UNITS

LURIA ENGINEERING CORPORATION

500 Fifth Avenue, New York 18, N. Y. | 1734 Candler Bldg., Atlanta 3, Georgia | Fidelity Philadelphia Trust Bldg., Philadelphia 9, Pa. | Chamber of Commerce Bldg., Boston 10, Mass. | First National Bank Bldg., Chicago 3, Illinois

PLASTICS was selected by the York Corporation for the grills on this Yorkaire Room Conditioner. For this service, a grill must resist greater than usual humidity and temperature change . . . must retain its clean, crisp lines and new-looking gloss. Tests proved that the right plastic would meet all of the requirements for this particular application.

Aico engineers carefully consider operating conditions when recommending the material to be used in a product. They will gladly work with you to make your product put on a better front in today's market . . . to help you gain your full share of prestige and profits.



● Polystyrene is used for this grill because of its ample flexual strength . . its thermal and moisture resistance beyond the demands of this air-conditioning unit. Its excellent molding qualities insure a high rate of production from a single cavity injection mold. The material is inert to the metal insert (A) which is molded in for rapid assembly. Clever mold design forms the louvres (B) without removable core pins. Stud (C) and lugs (D) hold the grill in alignment.

Aico has successfully applied plastics to a great variety of products. A Portfolio showing 28 actual applications with constructive comments to help guide you in designing for Plastics is yours for the asking. Write for it today.

AMERICAN INSULATOR CORPORATION
New Freedom, Pennsylvania

AICO PRECISION MOLDING
for over 32 years

MANY THINGS ARE BETTER BECAUSE OF PLASTICS

superior low temperature flexibility
excellent modulus, top plasticizing
efficiency, low heat loss

c. f. drew & co., inc.
15 east 26th st., new york 10, n. y.
chicago: 360 n. michigan blvd.
boston: chamber of commerce building

THE CARVER LABORATORY PRESS

FOR QUICK-ACCURATE-SMALL SCALE TESTS

.... in Plastics Laboratories

In photograph, plastic ash trays are being molded on the Carver Laboratory Press.

Plastic molding is only one of the many applications of the Carver Press. Here it is shown being used to mold ash trays in single-cavity compression mold. For such work the Press is equipped with Carver Standard Electric Hot plates. Send coupon for this useful example of a Carver Press application.

Recognized as standard for plastics research and development, the Carver Laboratory Press is used throughout the world. *"One of the most useful pieces of equipment any laboratory can have."* In these words a user sums up the variety of services performed by the Carver Press.

If you have a laboratory, small or large, you have many potential uses for this Press. One of its money saving features is the range of Carver Standard Accessories available as optional equipment.

Send today for latest Catalog. It illustrates the Press and accessories and describes some of the general applications.

SOME OF ITS MANY USES

Testing single-cavity molds.
Molding color samples
Production of samples.
Plastics instruction and demonstration.
Metallographic mounting.
Metal insert mold tests.
Vulcanizing.
Drawing.
Forming.
Embossing.
Bonding plywood.
Testing tensile properties.
Testing compressive properties.
Testing shear strength.
Flow tests.
Crushing tests.
Breaking tests.
Determining heat cycles.

The Carver Press provides complete range of temperatures from room temperature to 400° F. Adjustable by thermoswitch to within plus or minus 2° F. Equipped with accurate 6" gauge that provides load readings up to 20,000 lbs. Low pressure gauges optional. Carver Standard Accessories include Electric or Steam Hot Plates; Electrically Heated and Water Cooled Hot Plates; Carver Test Cylinders; Swivel Bearing plates; Cage Equipment, etc.

FRED S. CARVER INC.
HYDRAULIC EQUIPMENT
343 HUDSON ST. NEW YORK 14, N. Y.

Please send one of the free plastic ash trays that are molded on the Carver Laboratory Press.

NAME.....

FIRM.....

ADDRESS.....

"Your Plastics Department"

Presents EXAMPLES OF FINE WORKMANSHIP

#4

OF A SERIES

Designed for beauty as well as utility, these refrigerator parts are in service every day in both ice and mechanical refrigerators.

These are perfect examples of the versatile craftsmanship available at

"Your Plastics Department"

No detail is too small—no job too big. We invite your inquiries.

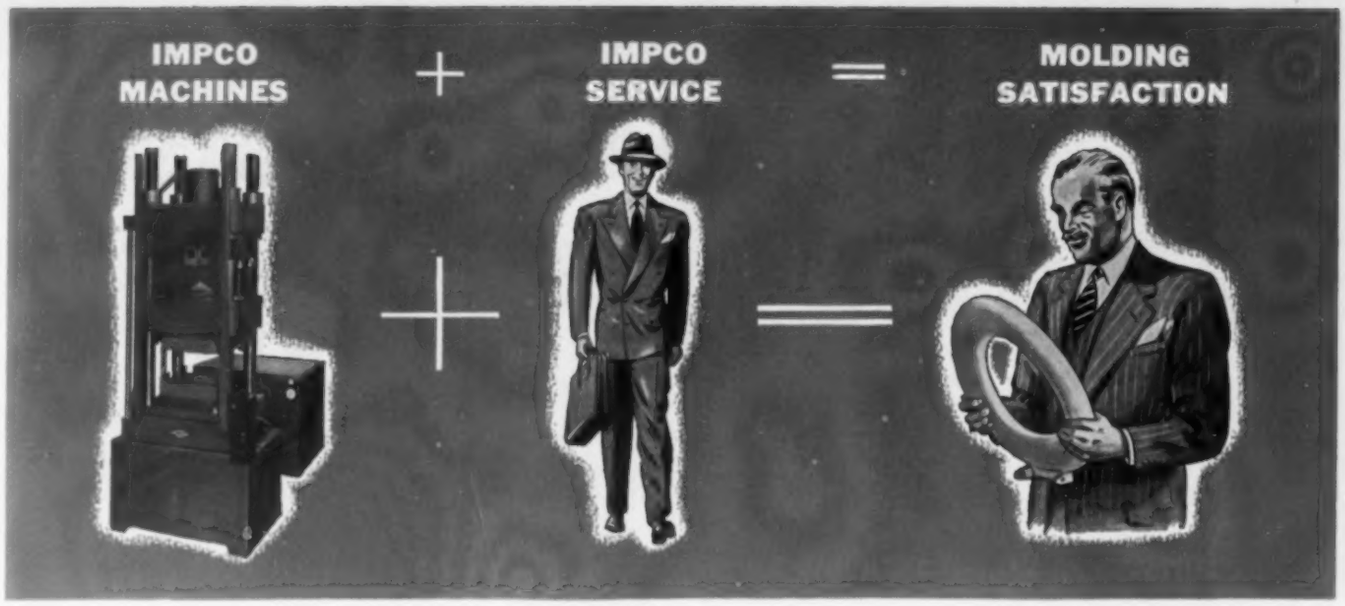
MINNESOTA PLASTICS CORP.

INJECTION MOLDING MINCOR YOUR PLASTICS DEPARTMENT

366 WACOUTA STREET
ST. PAUL 1, MINNESOTA

INJECTION MOLDING MINCOR YOUR PLASTICS DEPARTMENT

INJECTION MOLDING • FINISHING • ASSEMBLING • PACKAGING • PRINTING • PAINTING



What do **you** buy

when you buy a molding machine?

Impco machines are engineered to start right, operate right, and require little attention. However there are services and courtesies involved in getting the machine installed, instructing operators and helping you realize the full benefit from your equipment.

It's Impco policy: to furnish you with the most modern machines and to render willingly and cheerfully the services that are necessary.

We want *you* to be a satisfied customer. Write us about your plastic-molding problem . . . injection-compression, transfer, compression or straight injection.

MP-14

Impco

MOLDING MACHINES

PLASTIC MOLDING MACHINERY DIVISION
Improved Paper Machinery Corporation
NASHUA, NEW HAMPSHIRE

Below is the Impco Type VF machine. It may be used for:

(1) Straight injection molding of thermoplastic materials
(2) Injection-compression molding of thermoplastic materials
(3) Compression molding of thermosetting materials
(4) Plunger or transfer molding of thermosetting materials

Capacities: 1½, 2, 8, 12, 16, and 22 ounces.

NEW ORLEANS WELCOMES THE PLASTICS INDUSTRIES!

HOW TO CUT COSTS

by locating your new plant

IN NEW ORLEANS

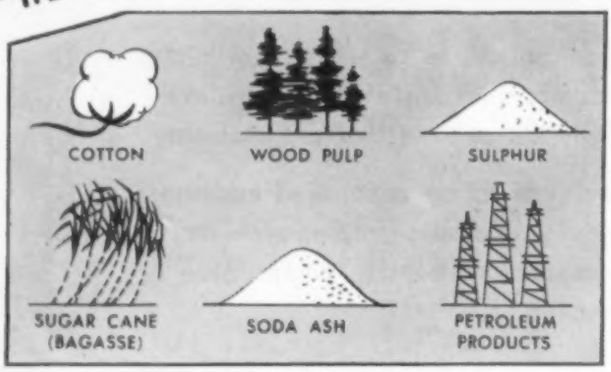
More Available raw materials, more economical transportation, more accessible markets ... mean more profitable operation.

MARKETS are bigger and more accessible from New Orleans. Not only the 30,000,000 people in the 10-state Southern Market, but the entire mid-continent area and Latin America can be quickly and economically reached from the South's largest, most prosperous city.

TRANSPORTATION is more economical—both for your nearby raw materials and for your finished product. A network of inland waterways, a port second only to New York in activity, efficient rail and air transportation are right at your door.

TAXES are lower, with a 10-year exemption plan for new or growing industries.
CLIMATE is healthful, free of extremes, beneficial to all-year, efficient production.
LABOR is plentiful, skilled, dependable. Lower living costs are conducive to better labor relations.

At your request, our representative will call on you.

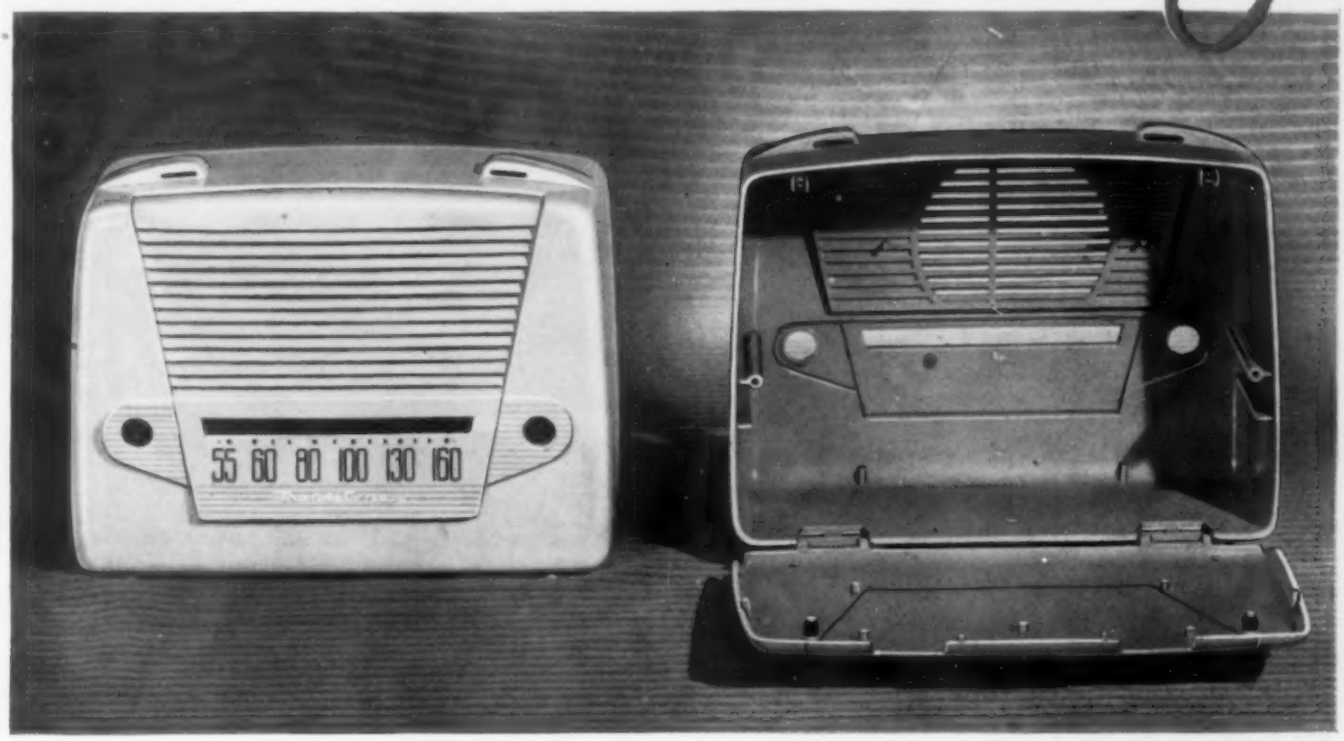


RAW MATERIALS for plastics abound in the New Orleans area. Soya beans, cellulose, lignite, carbon black, acids are all produced nearby, other materials imported regularly through New Orleans. And always available the ideal fuel—natural gas.

SEND FOR YOUR COPY
of our industrial study, "Manufacturing Opportunities in Plastics in New Orleans". Address: Dept. 62-B Greater New Orleans, Inc., 1024 Maison Blanche Bldg., New Orleans 16, La.

GREATER
NEW ORLEANS

THE PROOF IS IN THE *Molding*



SANTAY precision molding has clicked again. This time it's a new, portable radio cabinet . . an added proof of SANTAY ability in the field of injection molding thermoplastics.

The perfectly matched back and front of this set marks the successful culmination of a ten week tooling program. Samples were delivered on schedule, and with planned production resulting in top efficiency in Molding and Finishing Departments. Every part accepted by Santay as a suitable application for plastics is given this same thorough, planned production analysis, which in the long run results in lowered costs to the customer.

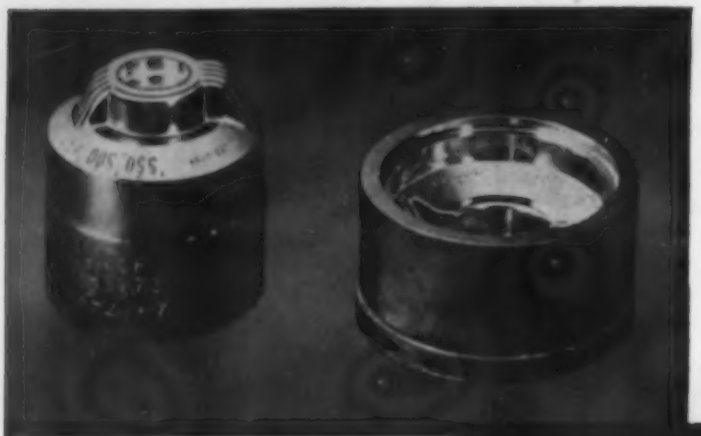
There are over 300 different parts in current production. These can illustrate to present and potential customers practically every conceivable application of good injection molding—plus a few *inconceivable* applications too! Without obligation on your part, we invite you to consult with our engineers. Their friendly cooperation and suggestions will go far toward helping you solve your problems to our mutual benefit.

Santay
SYMBOL OF PRECISION CRAFTSMANSHIP

INJECTION MOLDING AND METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES

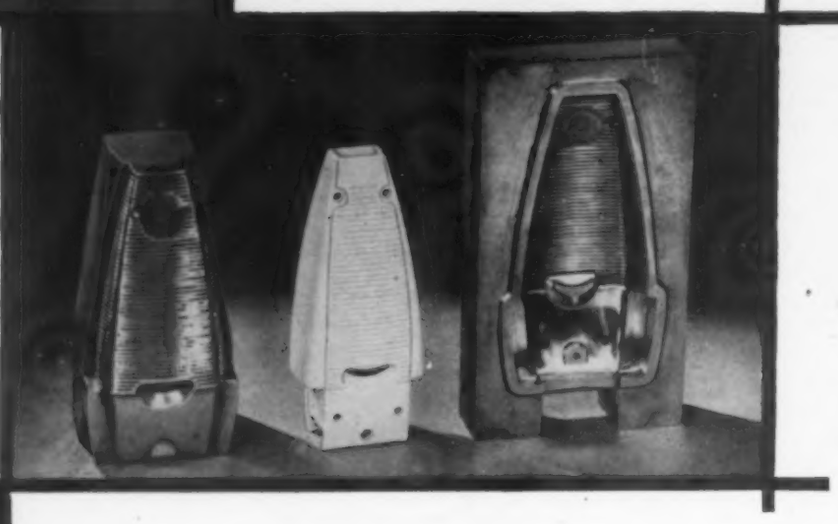
SANTAY CORPORATION, 355 NORTH CRAWFORD AVE., CHICAGO 24, ILLINOIS

REPRESENTATIVES: BURTON SALES CO., BRISBANE BLDG., BUFFALO 3, N.Y. • QUEISSER BROS., 110 E. 9th ST., INDIANAPOLIS 2, IND. • PAUL W. SEILER, 7779 CORTLAND AVENUE, DETROIT 4, MICHIGAN • C. E. WHITE & CO., BULKLEY BLDG., CLEVELAND 15, OHIO • WILLIAM S. RICHARDS COMPANY, 4903 DELMAR BOULEVARD, ST. LOUIS 8, MISSOURI • E. J. EDMUNDS, 5344 IRVING STREET, PHILADELPHIA 39 PENNSYLVANIA



DISSTON MOLD STEELS

SPECIAL TYPES TO MEET ALL MOLD REQUIREMENTS



Whatever the molding method you employ, or the size and shape of your products, one of the three special Disston Mold Steels will exactly suit your needs. Each is composed of carefully selected raw materials, and is produced in electric furnaces by modern steel practice, with every process under rigid control. Each is uniformly sound, carburizes evenly and produces unusually smooth cavities.

DISSTON PLASTIRON is a low carbon iron that withstands extreme hobbing. Recommended for difficult shapes and short runs.

DISSTON PLASTALLOY is a low carbon steel containing sufficient nickel and chrome to assure great core strength and resistance to wear, yet permit easy hobbing. Recommended for medium runs.

DISSTON PLASTIKUT is a "cut mold" steel with alloy content for maximum core and case strength. Because of its hardness, Plastikut must be machined instead of hobbed. But its ability to stand up under long runs makes its use economical.

Write for folder which tells what to look for and what to avoid in selecting mold and hob steels. Also contains analyses of Disston Mold and Hob Steels and other helpful information.

Disston metallurgists and engineers will be glad to help you find the right answer to your mold and hob problems.

STEEL:

Everybody who wants to obtain steel can help to get it by immediately starting scrap into channels that serve steel mills.

HENRY DISSTON & SONS, INC., 634 Tacony, Philadelphia 35, Pa., U. S. A.

NEW ENGLAND
Achorn Steel Company
381 Congress Street, Boston 10, Mass.

DISTRIBUTORS

METROPOLITAN NEW YORK & NORTHERN NEW JERSEY
Bright Steel Corporation, Offices & Warehouses, 528-540 West 22nd Street, New York 11, N. Y. and 224-236 Culver Avenue, Jersey City 5, N. J.

LIQUID

Phenolic Resins

RESINS FOR CASTING FORMING DIES AND TOOLS

HEAT AND ACID RESISTANT CASTING RESINS

WEATHERPROOF COATING FOR WOOD AND POROUS MATERIALS

BRISTLE SETTING CEMENTS

BONDING RESINS AND CEMENTS

LAMINATING AND INSULATING VARNISHES

CLEAR PHENOLIC LACQUER

The Marblette Staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

THE MARBLETTE CORPORATION

Manufacturers of Phenolic Resins since 1929

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MORE { WITCO QUALITY STEARATES

from A to Z

- ALUMINUM
- BARIUM
- CALCIUM
- LEAD
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- SODIUM
- ZINC

With the completion of our new Stearates plant in Chicago, which supplements the facilities of our Brooklyn plant, prompt shipment of WITCO quality STEARATES can be made either from Chicago or New York. Each shipment represents over a quarter century of experience in the manufacture of Metallic Stearates.

Quality STEARATES for over a quarter of a century

Samples on Request

WITCO CHEMICAL COMPANY

MANUFACTURERS AND EXPORTERS

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LOS ANGELES • BOSTON • CHICAGO • DETROIT • CLEVELAND • AKRON
SAN FRANCISCO • LONDON AND MANCHESTER, ENGLAND

DoALL BANDSAWS

...for Any Sawing Job!

ALL PLASTICS are sawed better, faster and at less cost with DoALL bandsaws—latest engineering achievements in sawing progress; time-tested by modern industry; do jobs previously considered impossible.

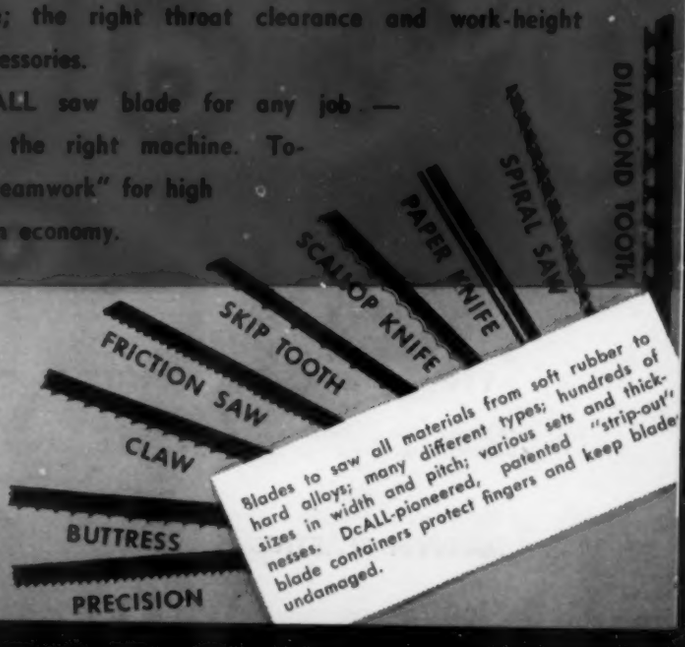
Many different models and sizes for shops large or small, priced to suit any budget. Besides, a DoALL bandsaw is "tailored" to exact requirements—the right cutting speed, set or variable; the right throat clearance and work-height capacity; the right accessories.

Also, there's a DoALL saw blade for any job — just as important as the right machine. Together they give that "teamwork" for high efficiency and production economy.

13 Models

high-speed bandsaws. DoALL—the world's ndsaw headquarters—is in constant touch th all industries; provides engineering as- tance on "sawability" of materials to cut oduction costs. Write about your problem.

-P-48


DIAMOND TOOTH
SPIRAL SAW
PAPER KNIFE
SCALLOP KNIFE
SKIP TOOTH
FRICTION SAW
CLAW
BUTTRESS
PRECISION
Blades to saw all materials from soft rubber to hard alloys; many different types; hundreds of sizes in width and pitch; various sets and thicknesses. DoALL-pioneered, patented "strip-out" blade containers protect fingers and keep blades undamaged.

The DoALL Company
Reg. U. S. Pat.

REPRESENTATIVES IN 56 COUNTRIES

DoALL STORES IN KEY CITIES

Des Plaines, Illinois

Cable Address: DoALL, Des Plaines

STURTEVANT

Dustless BLENDERS

Produce Perfectly Mixed Products with NO Loss of Materials

RECEIVING

The ingredients to be mixed enter the mixing chamber of the drum through a chute. Note scoops which carry up and dump the ingredients as the drum rotates.

DISCHARGING

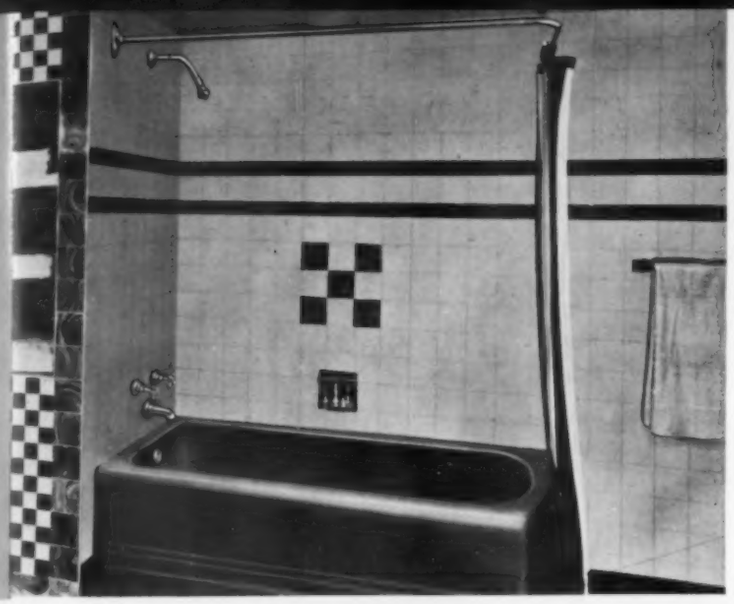
By simply throwing a lever, the inlet is closed and the mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

Four-way mixing action produces homogeneous blends. No matter what the densities, weights, finenesses or other physical properties of the ingredients, Sturtevant Dustless Blenders provide *a thoroughly blended product* with no substances floating to remain unmixed. Sturtevant advantages include—single opening for both receiving and discharging . . . "open door" accessibility for quick, thorough cleaning . . . rugged construction for long life and minimum maintenance. Sturtevant Dustless Blenders are available in mixing capacities from 500 to 20,000 pounds. Write for information or engineering assistance.

STURTEVANT MILL COMPANY
110 CLAYTON STREET, BOSTON 22, MASS.

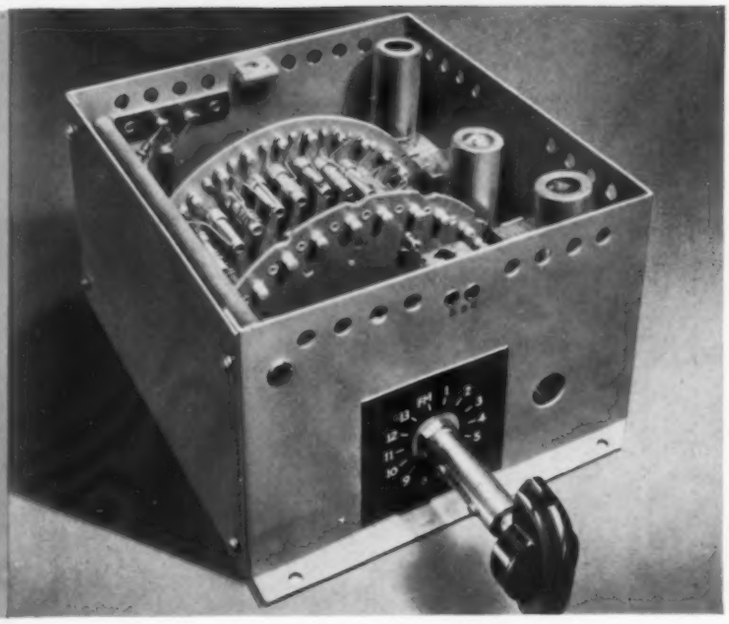
Designers and Manufacturers of

CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS



TILE that's tough, light, colorful and bright!

❶ Yes, new kitchen and bathroom plastic tiles in exquisite lasting colors, with toughness and light weight besides, are today answering many problems of architects, builders and decorators. Shown here are excellent examples molded from BAKELITE Styrene Plastic for Cermak Tile Company by Cleveland Plastics, Inc. They come in several standard sizes, in a wide range of colors, and their light weight is particularly advantageous in remodeling work.



BAKELITE NEWS NO. 2

NOTES FROM BAKELITE CORPORATION ON BETTER, FASTER, LOWER COST PRODUCTION WITH "BAKELITE" PLASTICS

It opens 13 eyes . . . selects 14 voices!

❷ Almost with a mind of its own is this channel-selector turret of "Andrea" television receivers. Fabricated from "Synthane" laminated plastic made with BAKELITE Phenolic Resin, this vital nerve center controls 13 channel-tuning circuits, plus an FM-tuning circuit. Its features? Superior electrical insulation for ultra-high frequency circuits, high mechanical strength, moisture resistance, and easy machineability.

Originality Unlimited!

— that's the thrill of working with plastics!

A smoothie . . . and a money saver, too!

❸ Here's a light, strong, dent- and marproof carrier for nylon and rayon stockings . . . that pays for itself in a matter of days by eliminating costly "picks" and "snags." Another triumph for "postformed" plastic laminates . . . it is fabricated by Formica Insulation Company from flat laminated sheet impregnated with BAKELITE Phenolic Resins. Postforming of laminates is showing many design engineers how to cut costs . . . in a wide variety of products.

PLEASE TURN THE PAGE

MOTOROLA'S tuned in to plastic's advantages

4 Using BAKELITE Phenolic Plastic, this radio-phonograph housing and lid are rapidly and economically molded to shape, lugs and bosses are formed, strength is provided where needed—each in a single molding operation! Finishing is largely eliminated. Additional plus-factors: Dielectric strength, dimensional stability, all-climate durability, permanent finish, cost reduction. Even color is an integral part of this material.

A three-dimensional view of plastics

5 View No. 1 is its ease of molding. No. 2 is its smooth, colorful finish. No. 3 its strength. So the choice is BAKELITE Styrene Plastic for the box that houses Sawyer's "View Master" three-dimensional color slide viewer . . . plus a whole library of picture reels. The handsome style, sturdy design and functional compartment separators of this light, eye-appealing case are achieved by a rapid injection molding process. The cover, of contrasting color, will retain its perfect fit because of the material's dimensional stability.

TRADE-MARKS

BAKELITE

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

Every Designer Should Know About The Expanding Family of Plastics

Check coupon below for information on specific subjects illustrated. For general information write for copy of booklet G-8 "A Simplified Guide to Bakelite and Vinylite Plastics."

BAKELITE CORPORATION, Department 6
30 East 42nd Street
New York 17, N. Y.

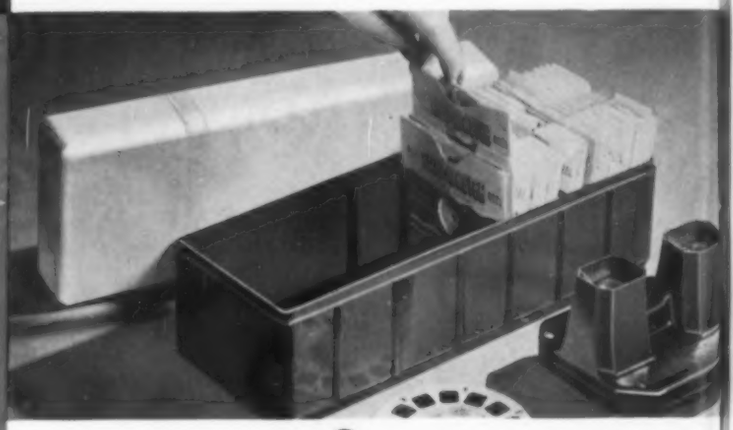
Please send information on subjects checked below:

- ☐ 1. Molded Styrene Plastics
- ☐ 2. Laminated Sheet Materials
- ☐ 3. Postformed Laminates
- ☐ 4. Molded Phenolic Plastics
- ☐ 5. Styrene Plastic Packages
- ☐ 6. Styrene Emulsions

Your Name ..... Title .....

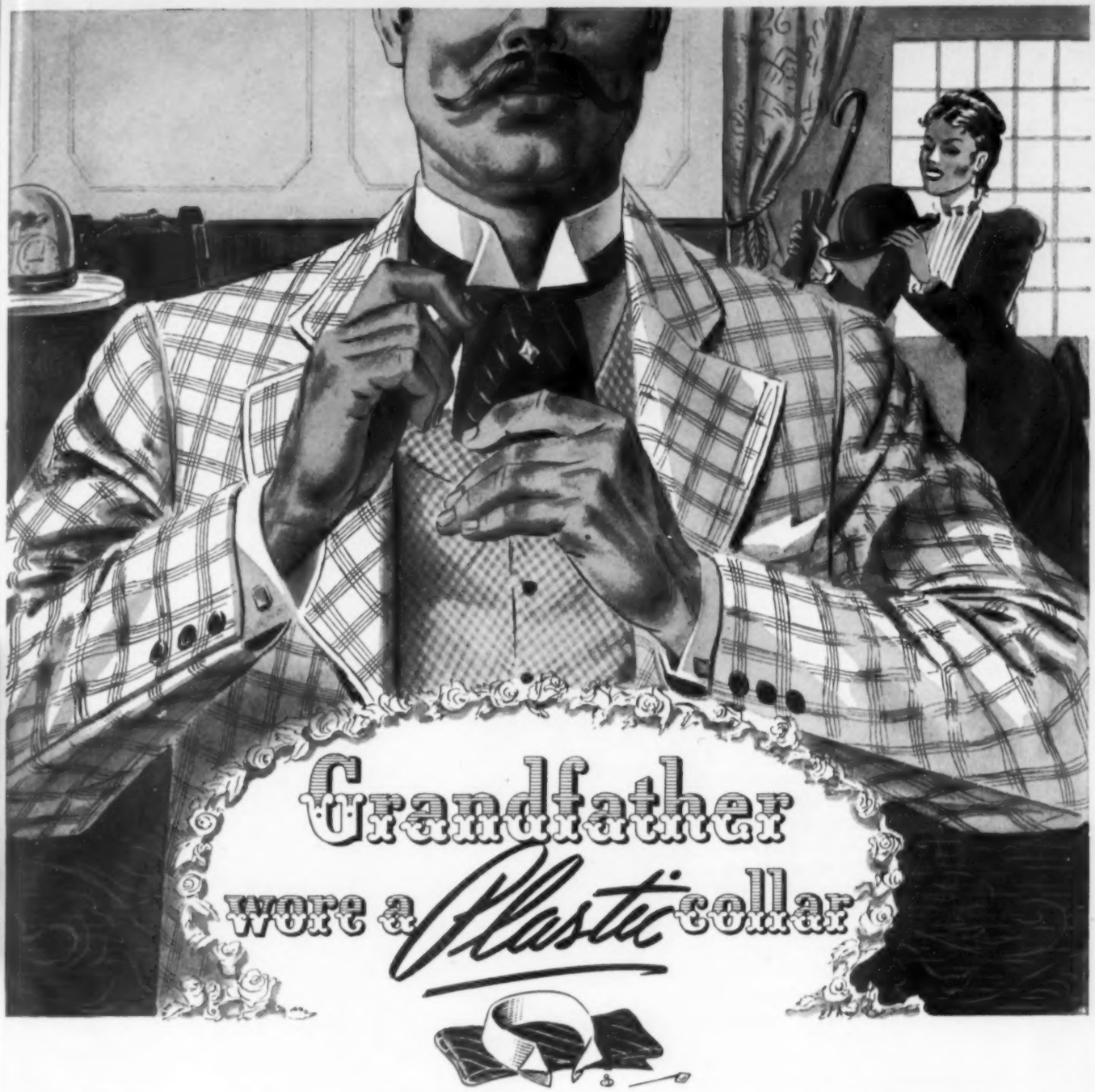
Your Company .....

Address ..... City ..... Zone ..... State .....



BATTERY MATS that go to the mat for you!

6 Longer life. Freedom from short-circuits. That's what everyone wants in storage batteries. These spun-glass mats that separate battery plates are made by The Glasfloss Corporation. Their fiber-reinforcing bonding agent is acid-resistant BAKELITE Styrene Emulsion. It permits the mats to be made so they guide battery gases away and keep plates from "treeing" and short-circuiting, thereby prolonging the life of the battery.



BACK IN 1873 plastic collars were the pinnacle of sartorial perfection. Of course, Grandfather probably never used the word "plastic", but that's just what those washable, durable celluloid collars were—plastic in one of its earliest forms.

Since then plastics have come a long way and the molding of plastics has become a business which, like any other art, requires years of experience to master.

Here at Watertown 300 of our employees have experience in molding plastics totalling more than 2000 years. The apprenticeship of many of these men dates back to the founding of the company in 1915.

Today — Watertown's modern facilities offer the best in products custom molded from all types of thermosetting and thermoplastic materials.

A "PLUS" WATERTOWN SERVICE

Periodic testings of all molded parts from basic material to finished product are routine in Watertown's completely equipped laboratory. Accurate readings in flexural, tensile and compressive strengths, as well as stress and strain curves are obtained from a machine specifically designed for the fatigue testing of plastics. Fissures, porosity and stray metal inclusions are detected by a new electronic X-ray unit.

THE WATERTOWN MANUFACTURING CO.
1000 ECHO LAKE ROAD, WATERTOWN, CONN.

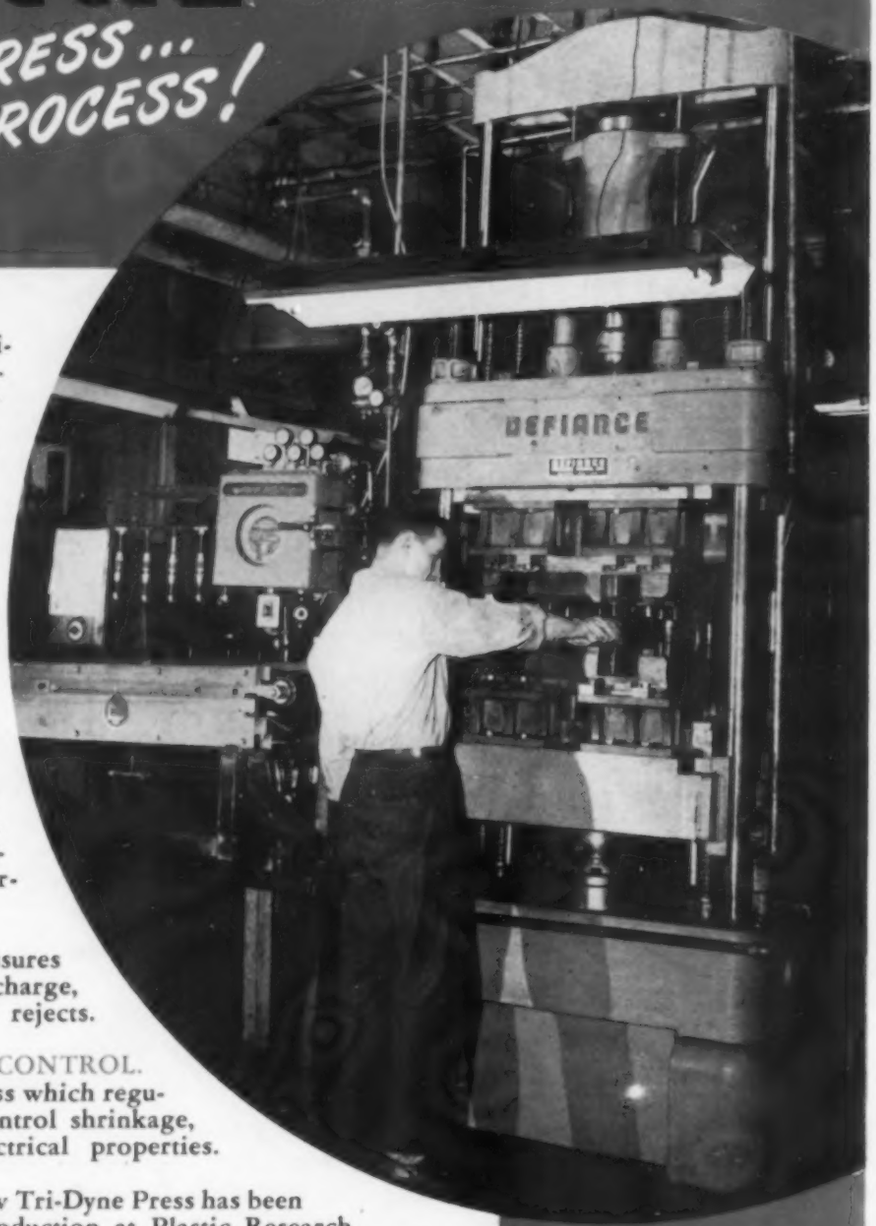
Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

DEFIANCE ANNOUNCES

TRI-DYNE MOLDING

A NEW PRESS... A NEW PROCESS!



New Defiance Model 153 Tri-Dyne Molding Press—*increases production . . . improves uniformity and accuracy* of plastic parts! TRI-DYNE Molding offers these *exclusive* advantages—

FAST HEATING—in three seconds or less, raises temperature of material *in the press* as much as 150° F. This reduces overall molding cycles, *resulting in 20% to 90% greater production.* Preheat temperature is lower than in ordinary molding methods—which permits use of less expensive preheating methods and eliminates handling of preforms at near-critical temperatures.

THOROUGH MIXING—assures uniform heating of material charge, more uniform cure, fewer rejects.

ACCURATE MOISTURE CONTROL. TRI-DYNE is the only process which regulates moisture content to control shrinkage, warping, strength and electrical properties.

Proven Performance! This new Tri-Dyne Press has been proved in 15 months of production at Plastic Research Products Co., Urbana, Ohio. Defiance also manufactures Plastic Preform Presses, No. 20 with 75 ton capacity, and No. 45 with 200 ton capacity. Write for bulletins. Defiance Machine Works, Inc., 2325 Madison Ave., Toledo 2, Ohio.

Defiance Model 153 Tri-Dyne Molding Press in operation at Plastic Research Products Co., who also use No. 20 Defiance Plastic Preform Presses for their preforming requirements.

98 YEARS OF PRECISION MANUFACTURING

DEFIANCE
PLASTIC PRESSES

THE New Look

FOR AN OLD BUSINESS

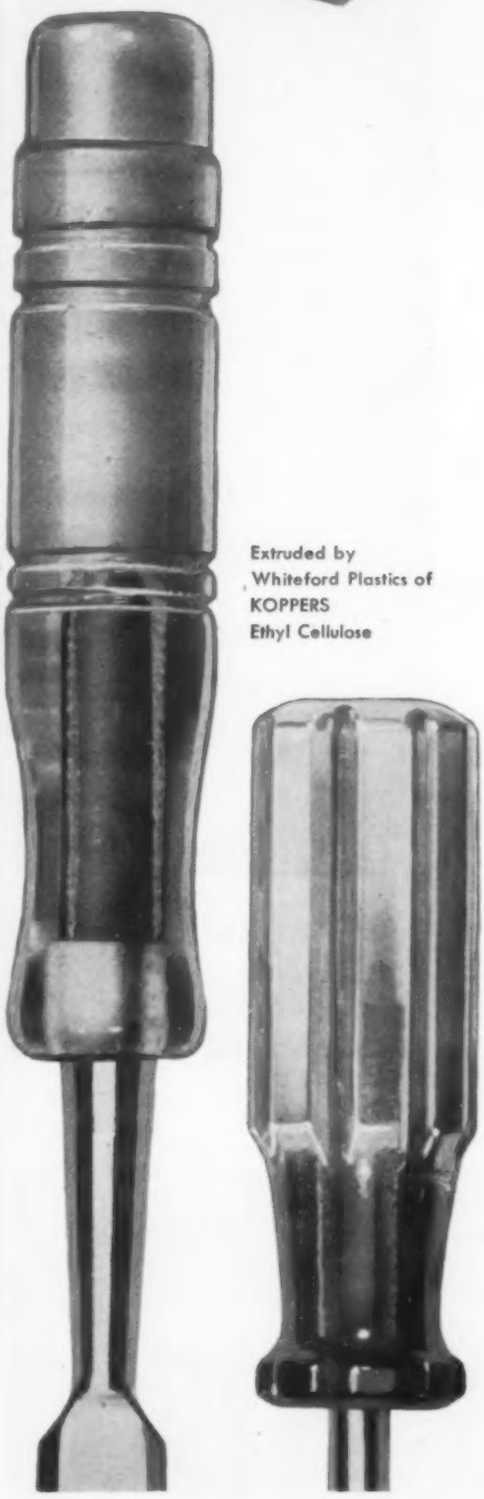
Koppers Non-Hazardous Ethyl Cellulose Supplants the "Old Way"

From molding powder, extruded in all sizes and lengths, to a machined screw driver handle is made possible by Koppers non-flammable ethyl cellulose.

It is tough, will not readily burn, can be hot extruded, and easily machined. A Koppers plastic handle is better because Ethyl Cellulose retains its toughness even at very low temperatures . . . and its grip on the blade is tighter and stronger than the "old way."

Koppers new Ethyl Cellulose is available in transparent amber, ruby, emerald, and sapphire as well as in a full range of translucent and opaque colors.

From raw material to finished rod, ready for turning, is a matter of minutes by hot extrusion, and no long seasoning is required. A Koppers plastic has made possible better and more easily manufactured tool handles.



Extruded by Whiteford Plastics of KOPPERS Ethyl Cellulose

Your Products Can Be Brought Up to Date with One of Koppers Three Molding Powders:

Polystyrene • Cellulose Acetate • Ethyl Cellulose

We will be glad to make a recommendation for the proper plastic for your manufacturing processes.

KOPPERS

KOPPERS COMPANY, INC.
CHEMICAL DIVISION
PITTSBURGH 19, PA.

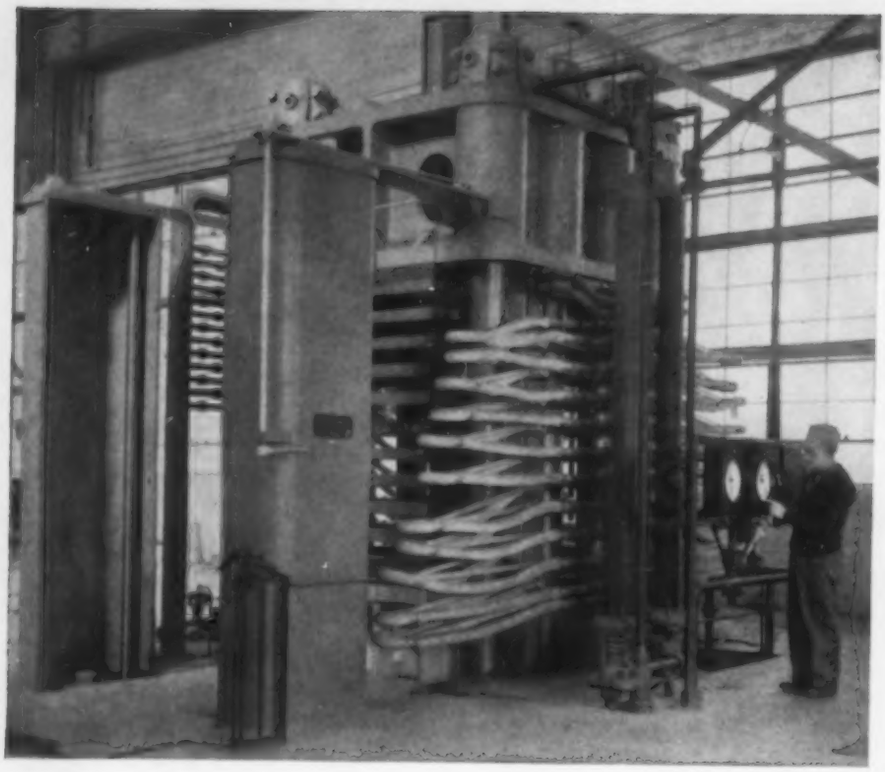
Koppers Company, Inc., Department MP6, Pittsburgh 19, Pa.

Please send me the Koppers chart, "Properties of 17 Rigid Plastics."

Name_____ Title_____

Company_____

Address_____



Want Your Press "JUST SO"?

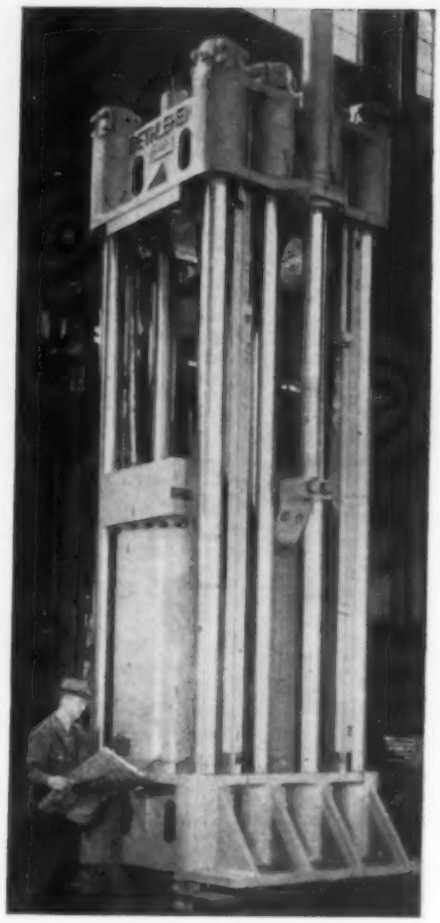
If you do, it means a built-to-order job—the only way we ever build hydraulic presses. Specifications come from you; they are followed in every detail, so that the finished press is exactly as you want it.

For the plastics field, Bethlehem is equipped to turn out both hot-plate and molding types. These can be furnished with or without self-contained or separate hydraulic power systems. See us, too, for presses used in other kinds of work — metal forming, the making of fiber board, etc.

When it's a Bethlehem press, it's a product of good engineering all the way through—a job you can depend upon. Inquiries are invited.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation



BETHLEHEM
Custom-Built
HYDRAULIC PRESSES

FOR PLASTICS • WALLBOARD
FIBER BOARD • VULCANIZING • METAL-FORMING
AND OTHER APPLICATIONS

BETHLEHEM STEEL

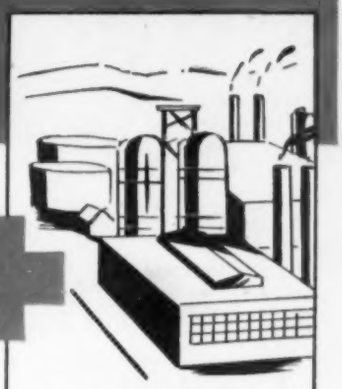
INTERLAKE *Resineering*

—the functional engineering of a resin to meet the specific requirements of each job

ANALYSIS
of your job.

DEVELOPMENT
of a resin for your specific application.

TESTING
this resin in your plant, working with your men.



CONTROLLED PRODUCTION
so that each shipment of the resin is uniform.

Results....

1. A uniform, dependable resin
2. Improved quality of product
3. Fewer rejects and production delays
4. A resin that costs no more

INTERLAKE CHEMICAL
Corporation
• PRODUCTS FROM COAL •

Let us tell you how Interlake *Resineering* has proved itself by successfully serving many leading resin users.

THE INTERLAKE CHEMICAL CORPORATION, Executive Offices: Union Commerce Bldg., Cleveland 14, Ohio; Branch Offices: 10 Post Office Square, Boston, Mass.; 332 S. Michigan Ave., Chicago, Ill.; 1855 Industrial St., Los Angeles, Calif.; Smith Tower, Seattle, Wash.

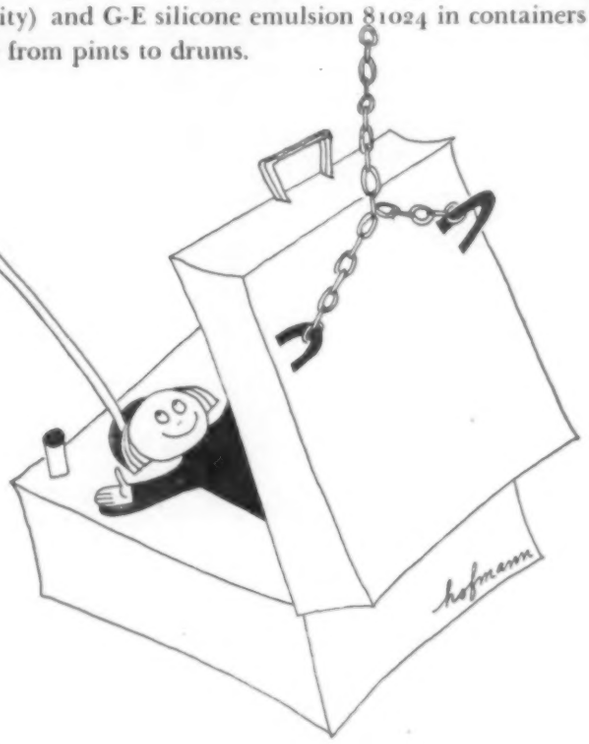
Is your product an "old-stick-in-the-mold"?

USE NEW G-E SILICONE MOLD RELEASE AGENTS!

● Are you troubled by costly damage in removing products from molds and dies? Then you'll be interested in the new General Electric silicone mold and die lubricants . . . a really revolutionary advance in molding and die casting.

These release agents are composed of G-E silicone oils developed to wet mold and die surfaces readily and penetrate small cavities because of their relatively low surface tension. This eliminates damage to molded parts due to their sticking to molds or dies. And silicone oils will not decompose and "build up" in the mold!

- Here are other reasons why G-E silicone oils are finding increasing uses as mold and die lubricants.
- General Electric silicone oils may be applied to *hot* molds without danger of decomposition at 400 F and higher.
- G-E silicone oils have a flash point above 600 F. They may be applied by brushing, spraying, or wiping at the consistency supplied, or after dilution with common solvents such as petroleum spirits or toluol. Emulsion types may be reduced with water.
- General Electric silicone oils are available immediately! You may order 9981 LTNV-70 (low viscosity) and 81092 (high viscosity) and G-E silicone emulsion 81024 in containers that range from pints to drums.



OTHER INTERESTING PRODUCTS OF G-E SILICONE RESEARCH

General Electric has gone far in the development of several other silicone products. These include silicone greases, rubber, and resins. All are characterized by a high degree of resistance to temperature extremes. There is also DRI-FILM* water-repellent material. It's a product of General Electric silicone research that offers effective moisture protection for plastics, glass, and ceramics.

WANT TO KNOW MORE ABOUT G-E SILICONES? We'll be glad to furnish you with additional information about these remarkable materials. Perhaps we can suggest a way in which they may be applied to your industry. Chemical Department, General Electric Company, Pittsfield, Massachusetts.

*REG. U. S. PAT. OFF.

Please address inquiries about G-E silicones to Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

SILICONES for Industry

GENERAL ELECTRIC

CD48-AH1

Where will KYS-ITE be used NEXT?

THE HOOD OF A VACUUM CLEANER ?

A HAMPER TOP?

A SINK DRAINBOARD?

Will you manufacturers or designers take us up on these suggestions? We'll gladly work with you . . . and you can be sure of this when you use KYS-ITE:

1. **PRODUCTION ADVANTAGES**—Unusual versatility. Pieces which other molders turned down as "impossible to produce" are among KYS-ITE successes. Odd shapes, pieces with projections, depressions or pieces of extra length. Other advantages: great strength with light weight, non-conductivity, good dielectric properties.
2. **SELLING ADVANTAGES**—There's selling power in KYS-ITE'S handsome appearance—its sparkling colors which can't wear off because they're part of the material. Also . . . its ability to take rough handling without splintering or chipping . . . its easy-cleaning qualities and resistance to stains.

Whatever your product may be—why not give it the KYS-ITE combination of advantages which no other type of material can offer. Special advisory service without obligation—write us today.

(Underside)

HIGH CHAIR TRAY

This KYS-ITE high chair tray—with its cored out construction, thin wall sections and accurately designed bosses for mounting of hardware—is an example of Keyes molding that engineers spark to. And thanks to its many practical advantages, KYS-ITE speeds up sales of Storkline High Chairs.

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES MOLDED PRODUCTS

KYS-ITE

(Reg. U. S. Pat. Off.)

Preformed Plastic Combining Long-Fibered Wood Pulp and Synthetic Resin

Problem solved—
using Fiberglas*-reinforced Plastics

How do we know? It's simple! Those satisfied looks prove that the problem is solved—that they're using Fiberglas reinforcements to design and produce a laminated product that is:

Light in weight and extremely tough.

Resistant to corrosion and rust.

Permanently colored: Eliminates original cost of surface finishing—no maintenance cost.

Easy to fabricate: Can be formed with either high or low-pressure laminating equipment—at minimum tooling cost.

Economical: Fiberglas reinforcements are available today, priced lower than most commonly used laminating reinforcing materials.

Want help on your problems? Want to know more about these materials and processes that can help you expand your markets and lower your fabricating costs on complete, finished or component parts? Then write today for a copy of "Fiberglas-Reinforced Plastics" Manual A9.3.1. It contains information on the properties, applications, economics and typical methods used in the fabrication of products of plastics reinforced with Fiberglas Mats, Cloths and Fibers . . . Owens-Corning Fiberglas Corporation, Dept. 876, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario

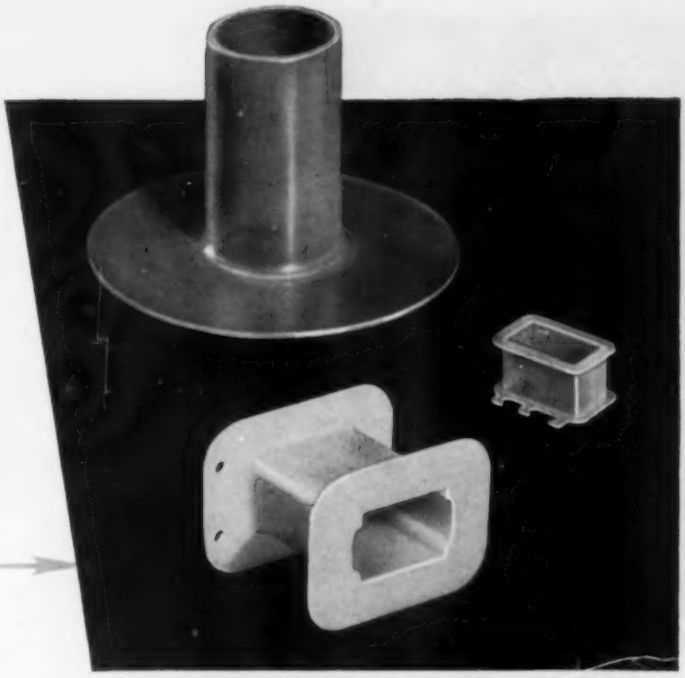
OWENS-CORNING
FIBERGLAS
REG. U.S. PAT. OFF.

PLASTICS
REINFORCEMENTS

*Fiberglas is the trademark (Reg. U. S. Pat. Off.) for a variety of products made of or with glass fibers by Owens-Corning Fiberglas Corporation.

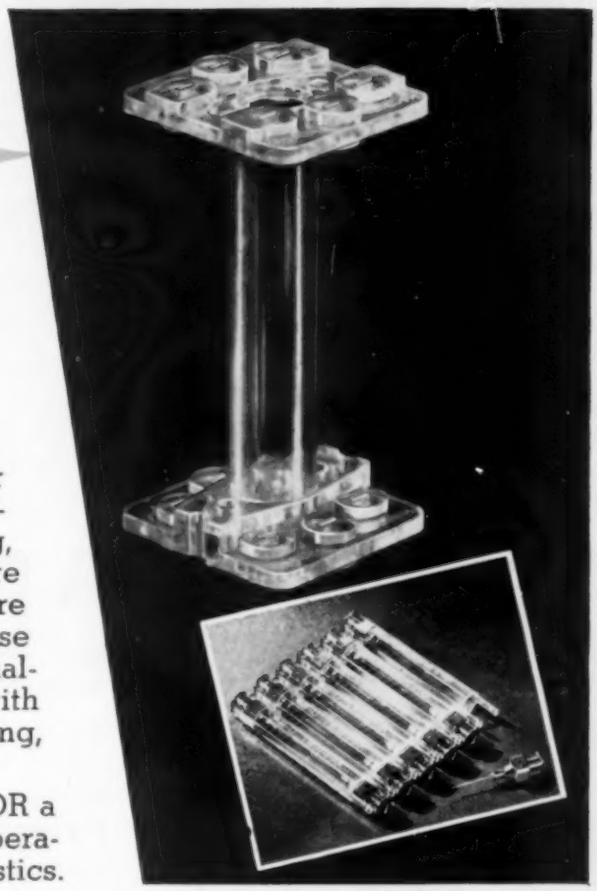
you can't treat a

POLYAMIDE



like a

POLYSTYRENE



There are more varieties of plastics in commercial use than of wood or metal; and two plastics may be as different as cork and oak, or mercury and steel.

A plastic is chosen because of the properties required in the finished article, not for the convenience of the molder. ERIE RESISTOR, the pioneer in custom injection molding, has lived with plastics from a time when there were not nearly so many of them as there are today. Having recommended a plastic because it will give the finished product the desired qualities, ERIE RESISTOR knows how to work with it, whether it's easy going and accommodating, or as temperamental as a prima donna.

Manufacturers will find at ERIE RESISTOR a versatile ability in molding and finishing operations to match the versatile qualities of plastics.

Plastics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND · TORONTO, CANADA.

ER SYMBOL OF QUALITY

Here's What's

IN STOCK FOR YOU

.. IN 48 ..

Molded Plastic

KNOBS, HANDLES, CLOSURES BY GRIGOLEIT

When your plans for 1948 call for versatile, smartly-styled, precision-molded plastic products—call on Grigoleit.

A complete line of attractive stock handles, knobs, pulls, pendants and closures is now available for immediate shipment. Eliminate mold costs and slow-downs. You'll be way ahead in time and money when you choose from Grigoleit's wide selection of stock molded plastic parts.

Consult Grigoleit now for stock or custom-molded plastic items. Write for colorful, fully-illustrated 28-page catalog.

In '48—depend on Grigoleit.

THE GRIGOLEIT COMPANY

"Twenty-One Years in Plastics"

744 E. NORTH ST. DECATUR, ILLINOIS

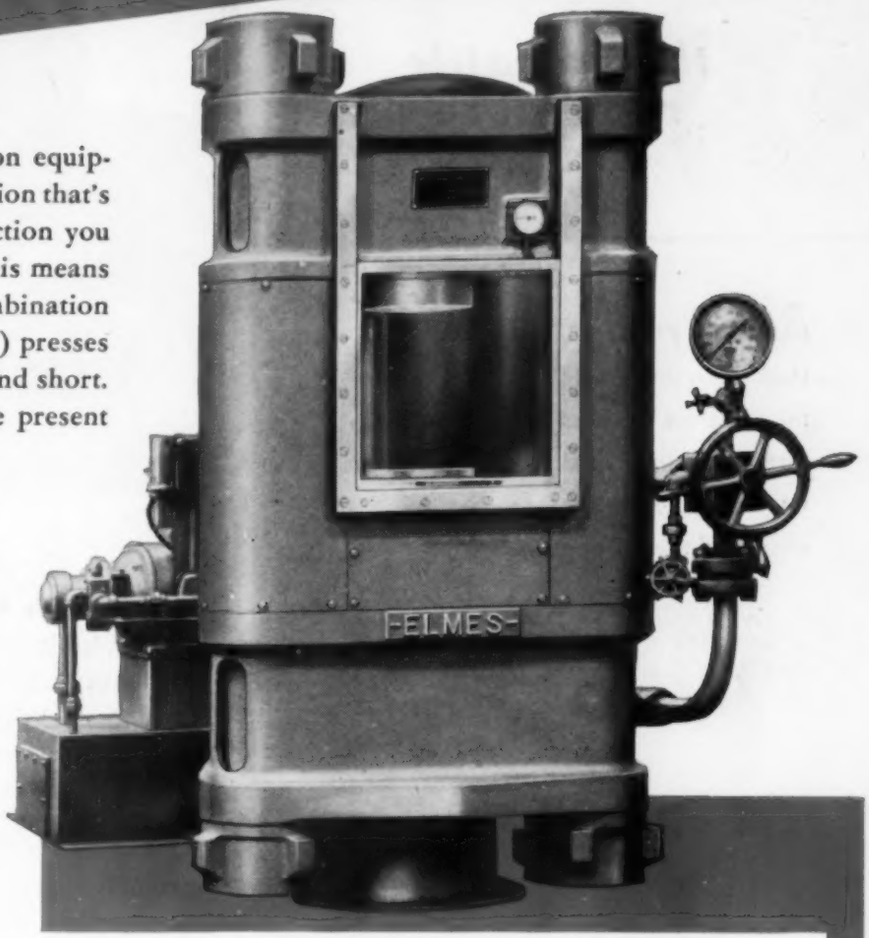
SPEED·POWER·CONTROL

BE SURE YOU GET ALL THREE!

What do *you* want from production equipment? *Production,* of course—production that's high in quality, low in cost—production you *sell at a profit.* To plastics molders, this means (1) good molds; (2) the right combination of pressure, heat, and curing time; (3) presses that can do a job on *both* long runs and short. Elmes users are sitting pretty in the present *"buyers' market."*

YOU'LL LIKE ELMES PERFORMANCE

Whether hobbing or molding, Elmes presses deliver the kind of performance you are *sure* to like. Into each has gone nearly a century's experience in building hydraulic equipment. Speed, power, control form the ideal working combination that only *objective engineering* can achieve. And, when it comes to special-purpose presses, a wealth of accumulated know-how makes *problem-solving* simple. "Put Your Pressing Problems up to Elmes" is more than just a slogan. *Try it,* and see!



Powerful Elmes hobbing or die-sinking presses form multi-cavity molds, duplicate die inserts, and intricate single cavities accurately, *economically.* Three-column design is rigid, compact. Quick closing, fast opening save precious time. Sensitive control cuts rejects, permits *precision* work.

Operator-safety is assured by protective guards on all three sides. Front is equipped with bullet-proof glass for viewing work. It slides up, out of the way, for easy access. Floor-level pumping unit is compact, quiet. Made in all pressure capacities to 5000 tons, and larger. Ask for Bulletin 1030B.

ENGINEERED BY ELMES

Good Hydraulic Production Equipment Since 1851

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 225 N. Morgan St., Chicago 7, Ill.

Distributors in Principal Industrial Centers • Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Here's another

NEW USE FOR

CO-RO-LITE

the versatile rope fibre plastic

ACWARE PLASTICS, in Los Angeles, California, find Co-Ro-Lite ideal for the manufacture of these picnic cases. Attractively made in different colors, the Co-Ro-Lite in this case is furnished in sheets all ready for molding.

CO-RO-LITE is a ready-to-mold, high-impact industrial plastic compound reinforced by long, tough rope fibres that form an interlocking system of remarkable qualities. It may be readily molded into compound curves and deep draws. Angles, channels and large shells are possible.

CO-RO-LITE is equally effective with fluid pressure or compression molding. The long, tough interlocking rope fibres reinforce all sections of the molded unit, imparting great impact, flexural, compressive and tensile strength. A range of densities comparable to wood is possible.

For *greater* strength, it's CO-RO-LITE, the rope fibre plastic. Consult our engineering department at any time. There is no charge or obligation, and you'll be amazed how Co-Ro-Lite, the *versatile* rope fibre plastic, can solve many of your difficult problems.

ALLIED PRODUCTS DIVISION

COLUMBIAN ROPE COMPANY

460-92 Genesee St., Auburn, "The Cordage City," N. Y.

Canadian Licensee: Canadian Bridge Engineering Company, Ltd., Box 157, Walkerville, Ontario, Canada.

TO

A Manufacturer who asks "HOW CAN YOUR MOLDING PLANT SERVE ME AS A LABORATORY?"

An open letter

Well, suppose you're grooming products to sell faster, or serve better, or cost less.

Maybe you're aiming at one of these objectives, maybe all of them. Anyway, you start with an idea. And right off you're confronted with questions of design and the selection of materials.

This is the point where many nationally known manufacturers have found it helps to bring Norton into the picture. On matters of plastics, and plastics in combination with other materials, our experience is the "laboratory" that serves both as a proving ground and a source of suggestions wherever a change will mean improvement.

We know the molding habits of the various plastic materials and we can match these against your design requirements. We know what characteristics each can impart to your finished product--and also which ones they can't. We are familiar with the advantages and limitations of each molding and finishing technique--and frank discussion on this matter has saved our customers plenty of grief.*

The truth is, the "laboratory" or pre-production phase of custom molding is so important that we've kept the word in our company name since the early 1920's when the whole plastics industry was an experiment.

So, while our modern molding machinery assures you efficiency in low production costs and precision accuracy, we think you'll agree that Norton can serve you best--first--as a laboratory in which you bear none of the investment expense.

We'll gladly work from a rough sketch or a verbal description--or from blueprints.

*Details on request.

NORTON Laboratories, Inc.

COMPRESSION AND INJECTION MOLDING

LOCKPORT, NEW YORK

"THE SECOND WORD IN OUR NAME COMES FIRST IN CUSTOM MOLDING"

UNION PACIFIC

The Governor of Utah *invites You*

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY

HERBERT B. MAW
GOVERNOR

To American Industry:

The State of Utah takes pleasure in presenting to American Industry an opportunity for new development and expansions.

The State of Utah prides itself on the quality of its people, the tremendous extent and ready availability of its raw materials, its unlimited power resources, its unequaled transportation facilities, and its friendly attitude toward business.

These factors, together with the advantages of living under ideal home surroundings in the nation's most interesting area, has already induced many fine industries to locate in our State.

A new industrial economy is developing in our commonwealth based on the substantial foundations of the basic materials available and the happy and contented people constituting the human resources.

The establishment of your business in Utah will give you an opportunity to share in this new industrial economy and to participate in the growth already experienced in the west.

Sincerely yours,

Governor

Herbert B. Maw

* *One of a series of advertisements based on industrial opportunities in the states served by Union Pacific Railroad.*

Unite with Union Pacific in selecting sites and seeking new markets in California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, Utah, Washington, Wyoming.

*Address Industrial Department, Union Pacific Railroad
Omaha 2, Nebraska

UNION PACIFIC RAILROAD

Road of the Daily Streamliners

UT YOUR COSTS OF XTRUDING CYLINDER WEAR

WITH *Xaloy*

AND *Xaloy 306*

(metal surfacing of exceptional wear and corrosion resistance)

Here's new protection against the costly effects corrosive plastics and abrasion on extruding cylinders, bers, and strainers. XALOY—as a revolutionary internal external metal surface for cylinders of any length, ameter, or wall thickness—provides remarkable resistance abrasive wear. XALOY 306, in addition, is amazingly mune to corrosion.

Actual industry reports show XALOY liners outlast the nventional type *many times!* And that's because of time d money-saving advantages like these:

XALOY is not affected by extruding temperatures or frictional effects.

Absolute uniform surface.

Absolute uniform depth hardness.

Exceptional hardness (62-68 Rockwell "C"); XALOY 306 (48-52 Rockwell "C").

Perfect metallurgical bond between XALOY and parent metal.

Offers freedom from iron and its catalytic effect on decomposition of certain plastics.

Can be adapted to any extruding equipment.

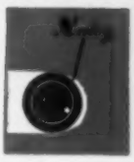
More and more leading manufacturers and users of extruding equipment are curbing production losses by adopting Xaloy liners.. both for newly designed equipment and as replacements in existing machines.

Photomicrograph (100x) shows perfect metallurgical bond between XALOY lining (upper half) and steel tube to which it is applied—*an absolute homogeneous bond.*

XALOY can be applied to *any* steel—on the outside or inside surfaces alone, or *both* outside and inside. XALOY-lined products are manufactured to your specifications only by Industrial Research Laboratories.

Proof of the corrosion-resistance of XALOY 306—Both rings were cut from same XALOY-lined steel bushing. The one at left was immersed in boiling Hydrochloric Acid until the steel backing was almost dissolved . . . *but the XALOY 306 liner remained unaffected!*

FREE! ENGINEERING AND PRODUCTION DATA BOOK to show you full technical details on how XALOY can reduce your losses from metal wear and corrosion.



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dustrial Research Laboratories, Ltd.

LOW COST INSERTS, FEWER REJECTS when ALUMINUM and PLASTICS team up

TEMPERATURE CONTROL KNOBS use Alcoa to prevent stresses and cracking in cooling. And at the same three-for-one economy that makes aluminum inserts a natural for plastics.

HANDLE INSERTS of Alcoa Aluminum for economy in molding, trouble-freedom in assembly and use—another case where low cost proves Aluminum-Plastics teamwork pays off!

ALUMINUM replaces chrome-plated steel, saves money! Alcoa mill-finished, coiled sheet aluminum gives three times as many louvers per pound, eliminates chrome plating.

Aluminum-Plastics teamwork pays off for Gill Griddle Lifter

Insert economy prompted Gill Electric Manufacturing Company of Redlands, Calif., to choose Alcoa Aluminum Inserts for this lifter, used to exchange grill and waffle plates on its Gill Griddle.

You're certain to reduce costs when you go to Alcoa Aluminum. The lighter weight means three times as many inserts per pound. No extra cost of plating, either. Alcoa Aluminum is corrosion-resistant, can be used bare bright (or in Alumilite* finishes, plain or colored).

Rejects are fewer because similar coefficients of expansion let inserts and molded piece shrink at the same rate while cooling, prevent cracking. Aluminum's coefficient of expansion is very close to that of most commonly used molding compounds—this case, Bakelite BM-2498.

Why not see how Alcoa Aluminum-Plastics teamwork can pay off for your product? Your insert manufacturer can supply stock inserts and information. Or write ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh 19, Pennsylvania.

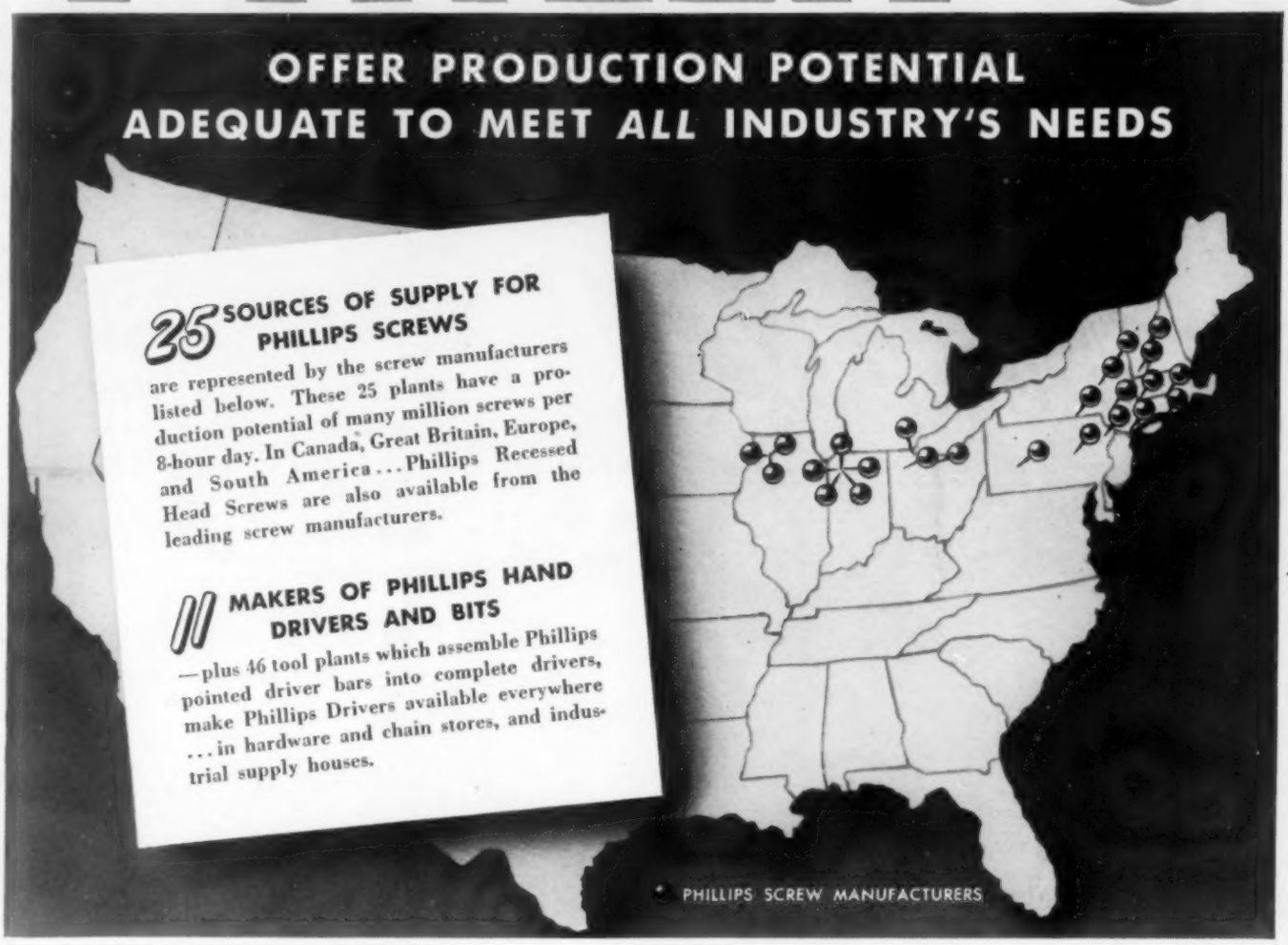
*Patented Process

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

ONLY PHILLIPS RECESSED HEAD SCREWS

OFFER PRODUCTION POTENTIAL ADEQUATE TO MEET *ALL* INDUSTRY'S NEEDS


25 SOURCES OF SUPPLY FOR PHILLIPS SCREWS
are represented by the screw manufacturers listed below. These 25 plants have a production potential of many million screws per 8-hour day. In Canada, Great Britain, Europe, and South America... Phillips Recessed Head Screws are also available from the leading screw manufacturers.
11 MAKERS OF PHILLIPS HAND DRIVERS AND BITS
—plus 46 tool plants which assemble Phillips pointed driver bars into complete drivers, make Phillips Drivers available everywhere ...in hardware and chain stores, and industrial supply houses.
PHILLIPS SCREW MANUFACTURERS

LOOK AHEAD when you choose a cross recessed head screw. Whatever the supply situation, at any time, this tremendous capacity makes Phillips Screws constantly available.

Wherever your product is sold and used, there are, and always will be Phillips Drivers available for disassembly and reassembly.

Remember, unlimited production potential is one of the basic essentials you can't afford to overlook in choosing a cross recessed head screw. With Phillips Screws, you can depend on it. Specify *Phillips*.

GET ALL THE ADVANTAGES OF ASSEMBLY WITH CROSS RECESSED HEAD SCREWS . . .

GET PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

25 SOURCES

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
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Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
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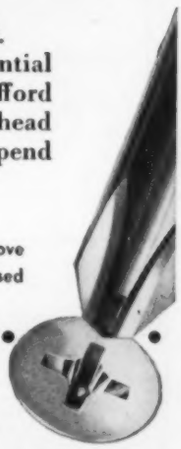
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wales-Beech Corp.
Wolverine Bolt Company

GET THIS NEW BOOKLET of facts that prove the top value, top economy of Phillips Recessed Head Screws. It's free . . . use the coupon.



Phillips Screw Mfrs.,
c/o Horton-Noyes Co.
1800 Industrial Trust Bldg.
Providence, R. I.

Send me the new booklet—"How to Select Recessed Head Screws for Practical Production Driving".

Name _____

Company _____

Address _____

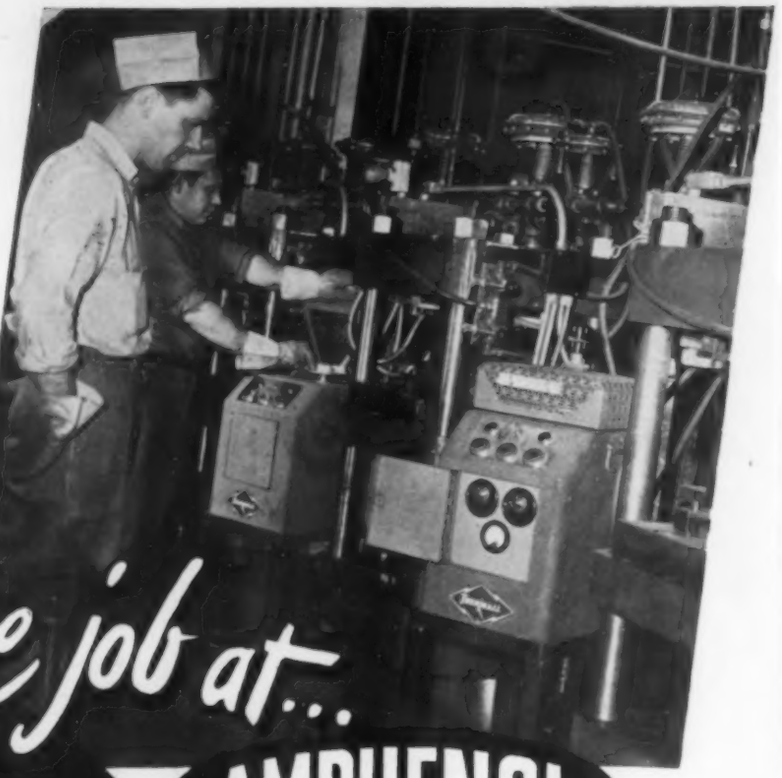
MP-30

THERMALL

Proven

HIGH FREQUENCY

PRE-HEATERS



Stay on the job at...

AMPHENOL

AMERICAN PHENOLIC CORP., Chicago, Illinois

A leading molder of electrical parts. . . . Here's what . . .

AMPHENOL SAYS:

"Set up on Amphenol 60 ton transfer molding presses, THERMALL High Frequency Preheaters are performing an excellent job. They are light, easy to move around and for that reason they are well liked by the molding room personnel. Breakdown time is negligible."

THE SUPER HORNET

Heatability	10 ozs.
Height	22"
Width	12"
Depth	19"

GENERAL PURPOSE PREHEATER

Leading molders and pioneers in plastics consider THERMALL headquarters for their preheating equipment. This reliability is a result of THERMALL's simplicity, ease of operation, and continuous performance products of thorough and progressive engineering design.

New York
Buffalo
Boston
Trenton
Detroit
Chicago

It will pay you to look into the many THERMALL advantages that enable you to produce superior plastic moldings. For information on the advantages, and uses or for demonstration anywhere in the world, write

W. T. LaROSE & ASSOCIATES, INC.
TROY, NEW YORK, U.S.A.

GUARANTEED PERFORMANCE...*or it doesn't cost you a cent!*

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All Foreign Countries

The Sacred Heart

Our Lady of Grace

Statuary Shown Actual Size

Note contrasting base color

For Devotional Statuary and Figurettes

Plastic Surpasses Plaster

Sculptures shown are injection molded of structurally strong acetate and are insured by replacement guarantees against chipping and breakage.

Every detail of the sculptor's original art is faithfully and expressively preserved thru proper mold design, mold construction and processing.

Its use, here too, bespeaks dignity, quality; possesses maximum appeal; exemplifies the type of custom craftsmanship you can look for when you look to Consolidated. Inquiries invited!

Your Blueprint in Plastic

CMP

Consolidated MOLDED PRODUCTS *Corporation*

309 CHERRY STREET, SCRANTON 2, PA.

Sales Offices: New York, Chicago, Detroit, Cleveland, Bridgeport

NEW
PRODUCT IDEAS
WITH
CELLULOSIC PLASTICS

NOW—MOTOR HOUSINGS IN

FLAME-RESISTANT ACETATE

Here's a new idea in fans—by Carl Sundberg, well-known industrial designer. By selecting flame-resistant cellulose acetate for the housing, an entirely new conception of a fan becomes practical—one which has acetate's toughness, color, and other desirable properties, as well as flame and heat resistance. Electrical manufacturers are now using flame-resistant acetate to make a variety of more saleable housings for Underwriters-approved products—electric shavers, mixers, vacuum cleaners, and blanket switches.

If you are interested in this new, flame-resistant cellulose acetate, write us.

Sectional view showing how motor housing is part of simple two-piece fan-frame assembly

MOLDED IN CELLULOSE ACETATE FOR

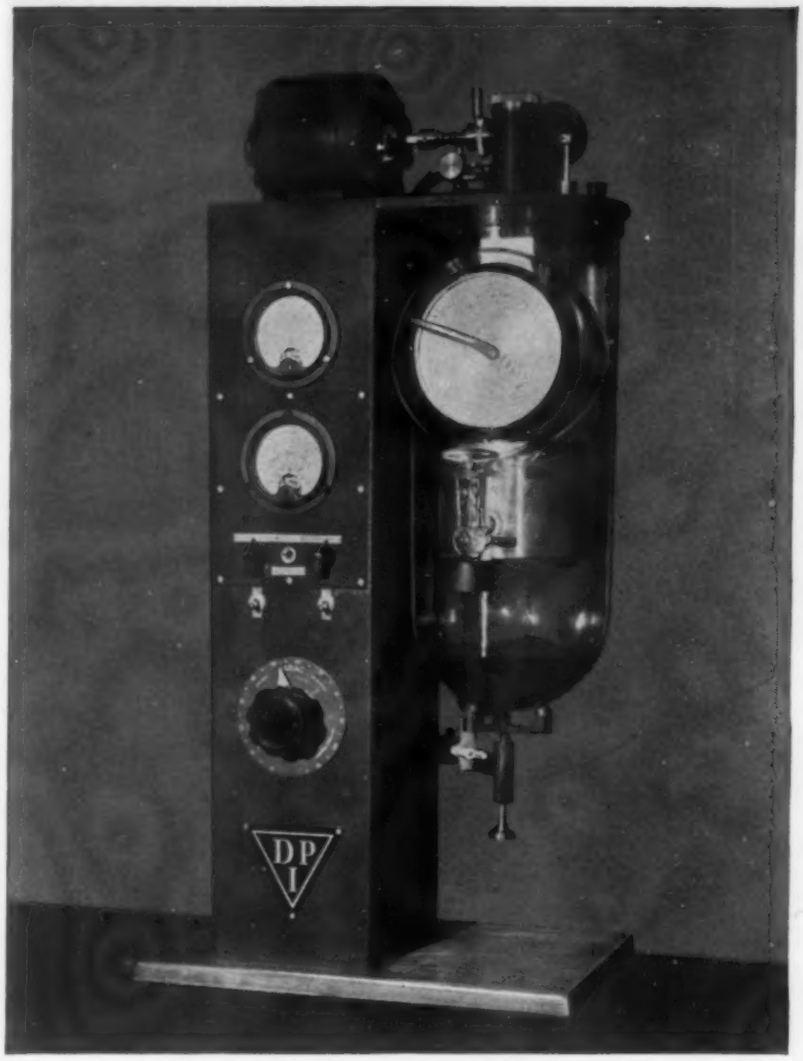
Heat and Flame Resistance — Impact Strength
Rich, Colorful Finish — Thin-walled Toughness
Dimensional Stability

HERCULES POWDER COMPANY
INCORPORATED
916 Market Street, Wilmington 99, Del.

SUPPLIERS OF HIGH-QUALITY CELLULOSE DERIVATIVES FOR PRODUCTS IN PLASTICS

CP8-6

CELLULOSE ACETATE • ETHYL CELLULOSE • NITROCELLULOSE



Here's the New Laboratory Molecular Still *with the* Centrifugal Evaporator

★

. . . the CMS "5"

first high-vacuum centrifugal still built as a bench unit especially for laboratory use, and selling complete for only $1920 F.O.B., ROCHESTER, N. Y.

The Molecular Still provides a unique method for the investigation of the chemistry of natural and synthetic oils, by its ability to separate heat-sensitive materials with molecular weights above 200.

The CMS "5" is simple to operate, rugged but built with fine precision. It is an indispensable tool for research laboratories, engineering plants, schools and universities whenever natural and synthetic oils and their derivatives are being studied.

NOW AVAILABLE FOR PROMPT SHIPMENT

If you wish further information send handy coupon for descriptive bulletin.

Features of the Type CMS "5" Molecular Still:

1. Rotating Evaporator. The substance to be distilled is introduced at the center of the 5″ rotor which, at a speed of 1725 r.p.m., spreads it in a thin uniform distilling layer.

2. Embedded Heaters. Rotor is made of cast aluminum with embedded electrical heaters. Assures maximum heat transfer from 70° to 300° C.

3. Variable flow rate. Gear device on the feed pump enables operator to select one of four possible rates of flow of distilland on to the rotor.

4. Convenient capacity. The Type CMS "5" Molecular Still handles samples from 200 cc up to one and a half liters.

5. Safe for sensitive substances. With exposure time of 0.05—0.2 seconds and pressure of 0.1—10 microns, distillations are performed with a lower thermal hazard than has ever been secured before.

6. Compact. All working parts suspended in inverted bell-jar which also acts as distilland reservoir and condenser. Still is 32″ high, occupies bench area 1½ x 2 feet.

7. Complete. Still includes vacuum gauges, temperature gauges, auto transformers for controlling heater inputs, etc. Requires only tap water for cooling vapor pump, and 110 V 60 cycle AC current.

8. Inexpensive. Price for complete unit, including still assembly, controls, combined booster and diffusion pump and necessary supports, $1920 F.O.B., Rochester, New York.

DP I

DISTILLATION PRODUCTS, INC.

779 RIDGE ROAD WEST • ROCHESTER 13, N. Y.

Manufacturers of Molecular Stills and High-Vacuum Equipment; Distillers of Oil-Soluble Vitamins and Other Concentrates for Science and Industry

DISTILLATION PRODUCTS, INC.
779 Ridge Road West, Rochester 13, N. Y.

Name..... Title .....

Company.....

Address .....

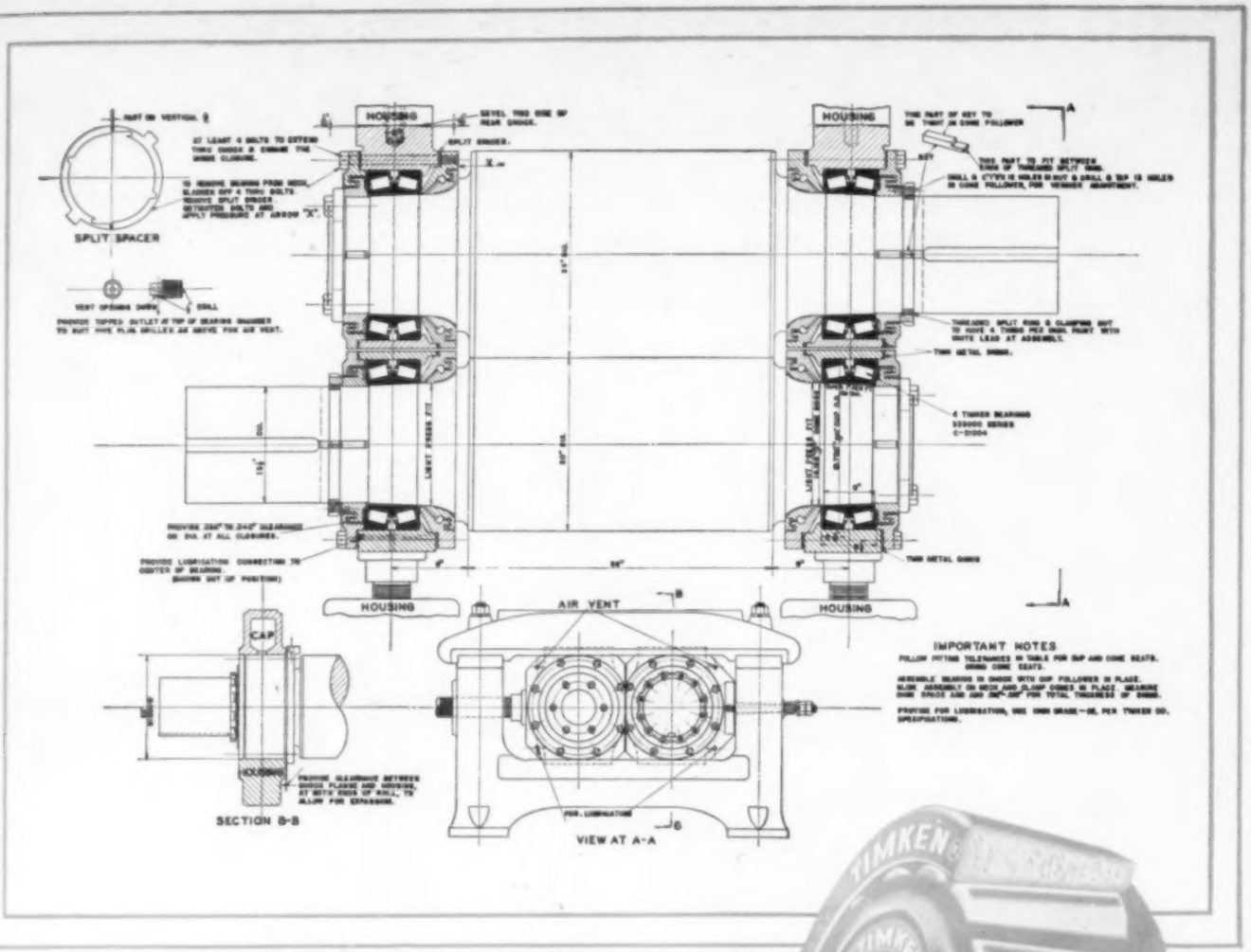
City .....Zone....State.....

DURITE

★ *FAST FREE CUTTING ACTION*
★ *DIMENSIONAL STABILITY*
★ *STRENGTH AND RIGIDITY*
★ *LOW WHEEL WEAR*
★ *LONG WHEEL LIFE*

Diamond wheels for precision sharpening of carbide tools excel in these properties when the diamond abrasives are bonded with DURITE phenolic resins onto cores molded of DURITE heat-resisting compound.

THE BORDEN COMPANY
Chemical Division
5000 SUMMERDALE AVE., PHILA. 24, PA.



Your Refiners Will Do A Better Job At Lower Cost

ON TIMKEN® BEARINGS

Plastics refiners, like compounding mills, operate smoother with less attention and lower power demands when the rolls are mounted on Timken Tapered Roller Bearings as shown in the typical arrangement here.

Friction is reduced to the point of elimination. Lubrication is simplified and economized. Radial, thrust and combination loads are carried on the tapered rolls and races with a wide margin of safety. Mill rolls are held rigidly in alignment under all conditions of operation. Roll life is lengthened because there is no wear on the roll necks.

Timken Bearing Equipped mills and refiners daily are proving their superiority, with substantial savings of time and money. The sooner you install them in your plant the more you will save. Our engineers will be glad to consult with you at any convenient time. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address, "Timrosco".

TIMKEN
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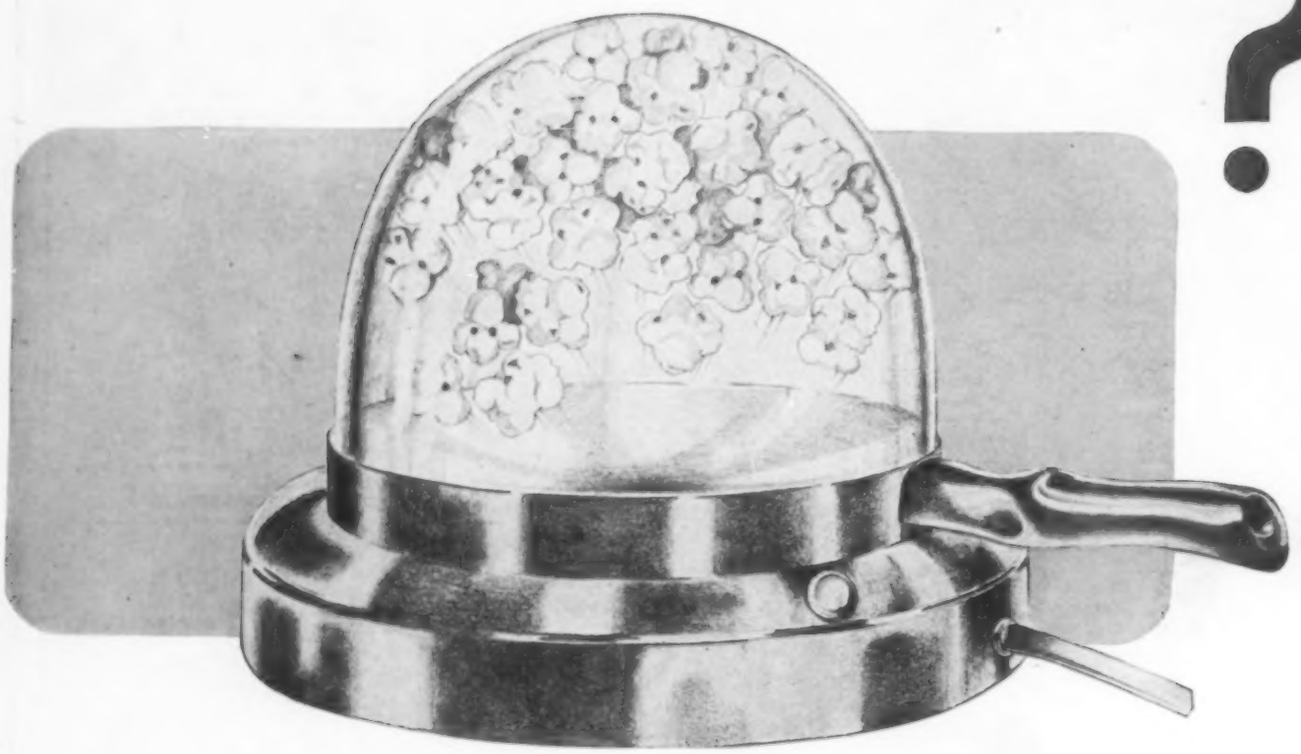

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Auburn's molding facilities and engineering department can play an important part in the development of this or any other new product. If you are planning a new design . . . or a re-design . . . consult with Auburn engineers in the preliminary stages for the most economical results.

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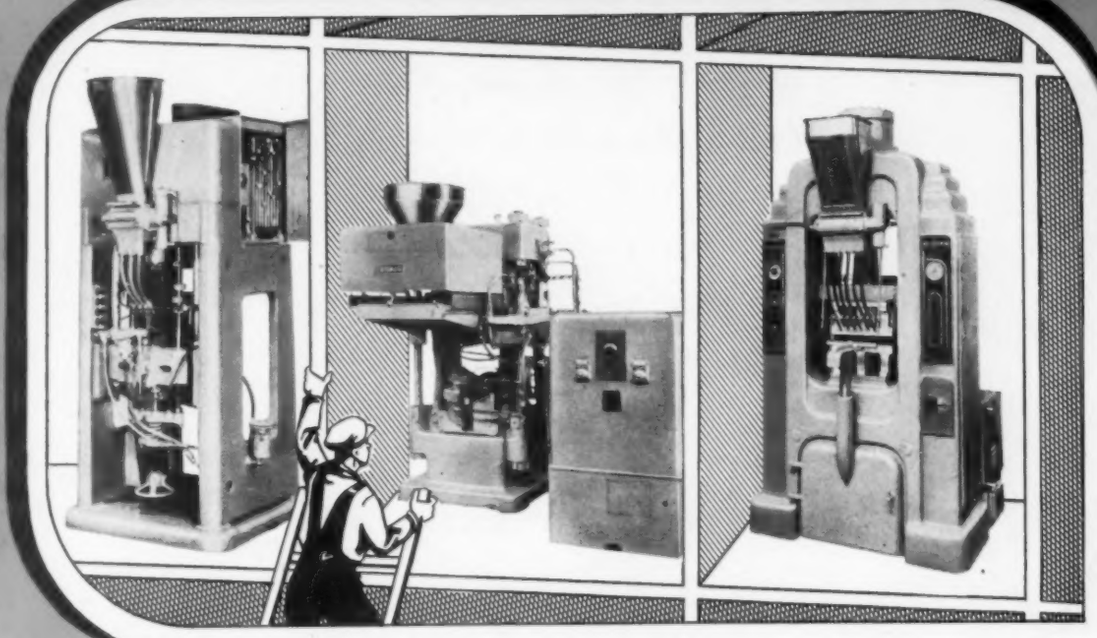

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Such a method of choice will lead you to the Stokes organization . . . to the one press *you* need from the Stokes full line of plastic molding presses.

Stokes engineers are experienced in planning operations for profitable production on all kinds of presses . . . fully automatic, semi-automatic, closure, plunger . . . special presses for special needs . . . and plastic preforming equipment.

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Stokes also makes Automatic Plastic Molding Machines, Closure Presses, Preforming Presses, Powder Metal and Ceramic Presses, High Vacuum Processing Equipment

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If you are adding molding equipment, you will want to know about the new and improved Stokes-Standard presses. Their unique design coupled with high-efficiency hydraulic equipment gives you more heats per hour with less mold wear and lower operating cost. Automatic cycle control permits an operator to run more than one press. Low hydraulic pressures require little operating power. Each press is completely self-contained. Good deliveries on all models, from the 50-ton to the 300-ton size.

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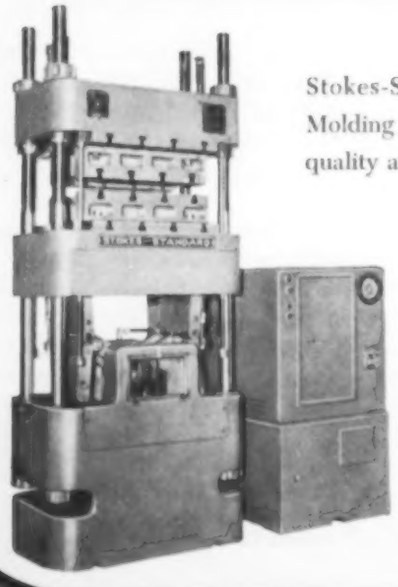

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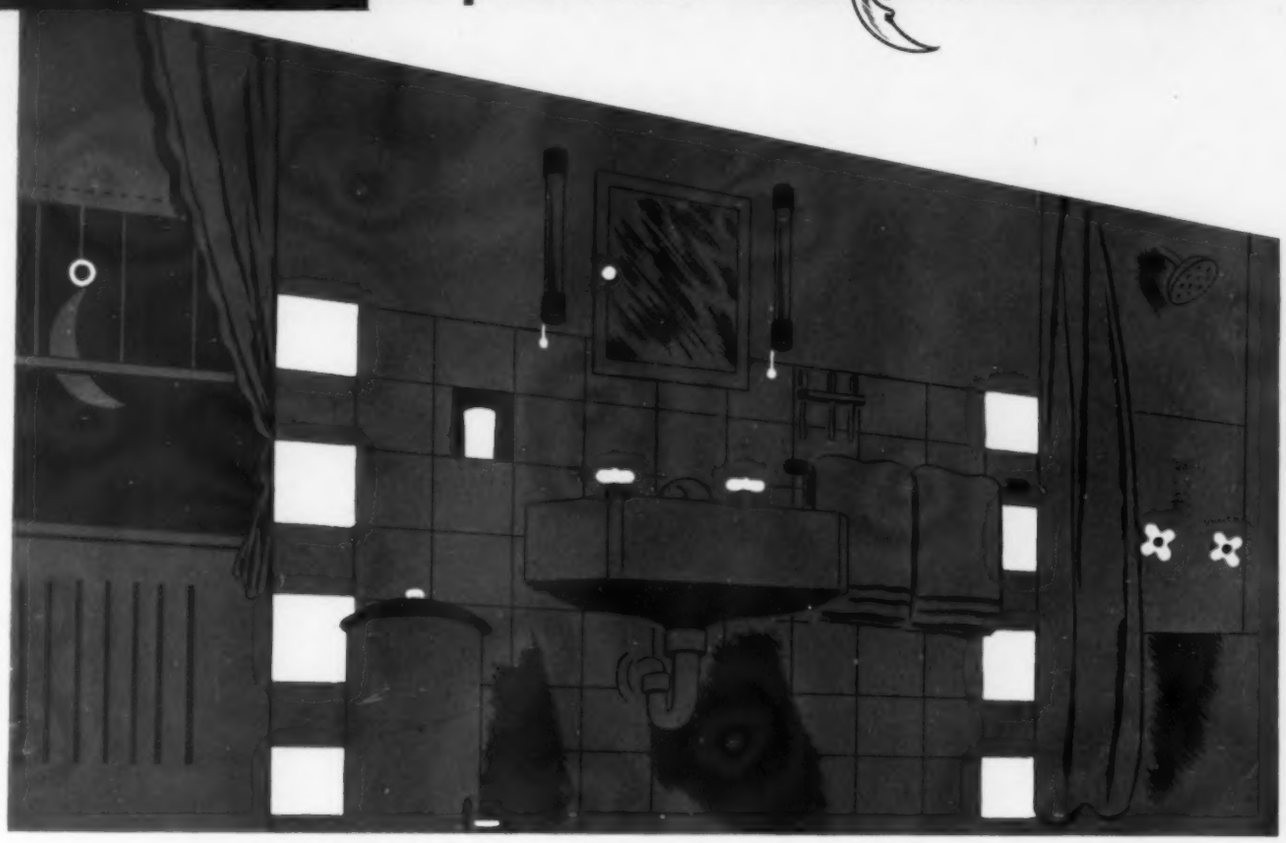
STOKES KNOWS HOW

PAULITE the plastic that's BRIGHT at NIGHT



Articles made from PAULITE — the amazing new luminescent molding compound — are ivory-white under normal conditions and emit a revealing, bright blue glow in the dark. PAULITE is activated by sunlight or artificial illumination and gives off a strong afterglow for more than 10 hours in total darkness! Hence, items molded from PAULITE, in addition to being useful, have high novelty appeal.

Unlimited applications

The uses to which PAULITE can be adapted are limited only by imagination and ingenuity. It can be utilized for molding toggle switch plates, clock faces, drawer pulls, house numbers, markers, door knobs, telephone dials, automobile, aircraft and marine accessories, wall tile, flashlight cases, flashlight lens heads — anything which must be found or seen in the dark.

Easy to use

Luminescent PAULITE comes in ⅛" to ¼" granules — polystyrene, polyethelene or Tenite II* basis—ready for immediate molding. You handle PAULITE just as you would any other molding compound — it requires no special treatment during molding.

THE PREMIERE IN LUMINESCENT PLASTICS
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"It's PAULITE in sight day and night"

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Please send us detailed information on PAULITE'S physical properties and colors. Include data on prices and delivery dates.

Name.....

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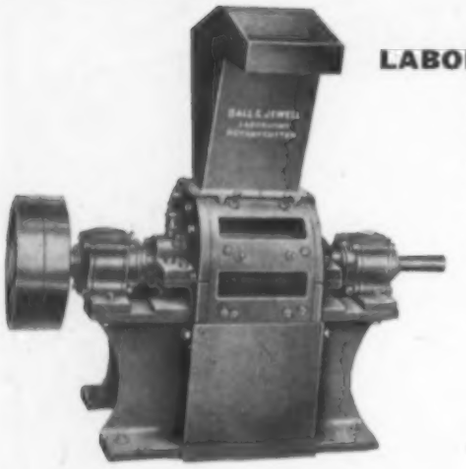
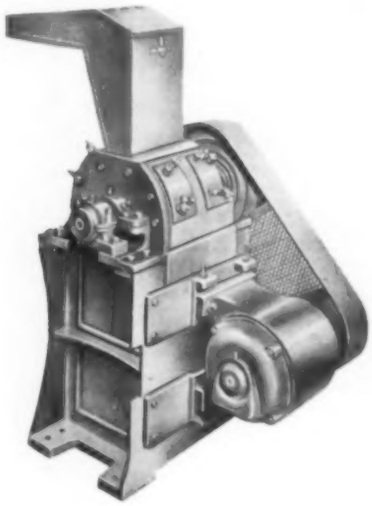


LABORATORY MODEL

Small enough for Laboratory service, it is also ideally suited for capacities up to 100 pounds hourly, depending on materials being reduced and fineness of product desired.



HEAVY DUTY IDEAL

Similar to Standard Ideal except fly knife centers, check pieces, knives and bolts are heavier in construction; all castings are semi-steel; and a 5 H.P. Motor provides extra power to reduce heavier stock, up to 1" thick.

NO. 1½ MODEL

This rotary cutter is designed to do moderate work in volume quantities. Note particularly the pulley which is attached on the right shaft end rather than the left. This is another example of the outstanding installation adaptability of all Ball and Jewell machines. Drive from either end possible.

Ball & Jewell, Manufacturers of Patent Rotary Cutters Since 1895

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Resistance to petroleum hydrocarbons, along with non-toxicity, wide compatibility, excellent solvency and general chemical stability, makes these Monsanto glycolates ideal for use with vinyls, cellulose acetate, nitrocellulose and synthetic rubbers of the Buna-N type, in the production of tough, flexible films, sheets and tubing.

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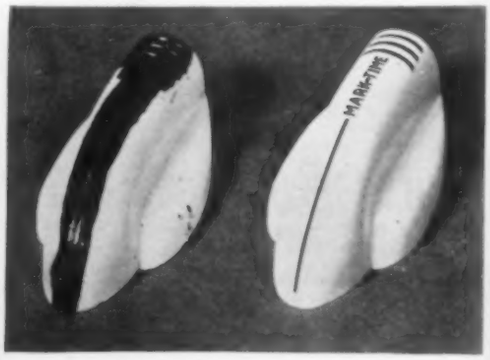
This plant also uses Lea Compound with recommended methods for removing sprues, fins and residual flash from a wide variety of molded parts.

How about your finishing shop? Is it as efficient and economical as you would like? Perhaps Lea can assist you in cutting your finishing cost, increasing your volume, and improving the quality of the finish. Our engineers will be glad to submit recommendations.



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PLASTOLEIN 9715

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Polyvinyl acetate compounds containing Emery's Plastolein 9715 are very flexible, tough and clear.

Recommended for adhesives, oil-resistant paper coatings, cellophane lamination, etc.

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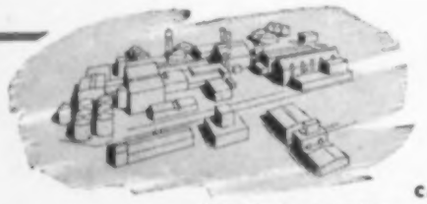
Typical analysis and properties:

Color (Gardner)	7
Refractive Index	1.4637 (25°C)
Specific Gravity 20/20	1.083
Viscosity (poises at 25°C)	4
Cloud Point	−8°C
Viscous Point	below −20°C
Flash Point	530°F
Fire Point	595°F

Other Emery Plasticizers

PRODUCT	COMPOSITION
"Plastolein" 9055	diethylene-glycol dipelargonate
"Plastolein" 9058	dioctyl azelate
9050	dihexyl azelate
"Plastolein" 9250	Tetrahydro furfuryl oleate



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VOLUME 25 JUNE 1948 NUMBER 10

MODERN PLASTICS

RUBBER or PLASTICS

As both plastics and rubber materials improve, the battle for markets becomes more furious. Which material will win in what fields, and where will they join forces?

THERE probably has never been a new commodity of such great importance and size developed in such a short time in the United States as GR-S synthetic rubber. Recent government legislation indicates that at least 200,000 tons of it will be used in each of the years 1948 and 1949. Although this amount is only a fifth of the estimated capacity for GR-S, it is still a substantial quantity—enough to indicate that GR-S is a factor to be reckoned with in the rubber industry . . . and in the plastics industry.

Now that GR-S is established, what is going to be done with it? What will it mean to the national economy? How will other industries be affected? Particularly, what is its significance to the plastics industry?

The last question is the one with which this article is most concerned. There is no clean-cut answer. The argument over whether or not GR-S will capture an ever-increasing quantity of the natural rubber market goes on endlessly. Great amounts of natural rubber will doubtless be consumed for a period of years to come, but its star has dimmed unless the history of the American chemical industry is no harbinger of things to come. Dyes, nylon, and chemical fertilizer are mute evidence that the chemical industry does not surrender to imported commodities of similar ilk after production problems have once been whipped. It is possible that chemists have prepared a shroud, or at least have stunted the future, for natural rubber, just as they have in the past for indigo, camphor, cinchona, and the lowly silk worm.

Plastics are involved in this GR-S development for three main reasons.

1. Both materials compete for some of the same raw materials, principally benzol from which styrene is derived.

2. Both compete in various end products.

3. The raw materials, styrene and butadiene, from which GR-S is manufactured, can be used in a great variety of combinations, or with other chemicals, to form another family of resins that will be used in competition with and to supplement plastics compounds now in existence.

For an understanding of this situation, it is necessary to set up a background on GR-S development in the United States. There are several other types of synthetic rubbers, such as nitrile, butyl, and chloroprene, but this article is concerned principally with GR-S which was developed primarily as a tire rubber. Each of the other types is a story by itself, and our readers are already familiar with the great possibilities of nitrile rubber[1] when used in conjunction with vinyl, phenolics, styrene, and other materials. All these various rubbers have special uses which may or may not compete with plastics, but their tonnage today is limited compared with GR-S.

When this country's people became alarmed about rubber shortly after the war began, American rubber chemists recommended Buna S (later renamed GR-S) because it was an all-purpose rubber, and the raw materials, styrene and butadiene, seemed most quickly available. Rated capacity increased from 10,000 tons in early 1941 to 705,000 tons at the war's end, but actual capacity at the latter time was estimated at over 1,000,000 tons.

(*Please turn to next page*)

[1]See "Acrylonitrile moves into plastics," MODERN PLASTICS 25, 91-96, Oct. 1947.

COURTESY UNITED STATES RUBBER CO.

COURTESY BAKELITE CORP.

Rainwear is a big outlet for both rubber and vinyl. Rubber footwear (left, above) still predominates, although a vinyl overshoe for children has just been announced; raincoats employ a wide variety of materials. New metallized vinyl (center) gives added styling characteristics to plastics coats. A survey shows only 28% of women buy raincoats; new cast vinyl film umbrella (right, above) will interest the others

The factor of particular interest to plastics processors in this development is the increasingly better grade of GR-S type rubber that continues to come from the mills. One rubber expert says that the original American GR-S was worth about 16¢ in comparison with natural at 22¢ and that it could be used in about 16% of the products made from natural. On the same evaluation today, GR-S would be worth 19¢ or 20¢, and the percentage of places it can be used is constantly increasing.

Continual improvement in GR-S can be expected, and it is this ever-present potential that puts far-seeing plastics producers on guard, for there isn't much doubt that GR-S type rubbers will be tailor-made for special consumer items in an attempt to usurp markets now occupied by plastics or natural rubber. In line with this thought, a man whose expert knowledge is highly regarded by practically every rubber and plastics producer in the country has stated that "perhaps GR-S is too much of a plastic to be a real good rubber."

Some chemists claim that a 20-yr. research job on GR-S was done in two years during the war. The result was a rubber tire which, while not perfect, kept America on wheels. Furthermore, it is far superior to anything the Germans were able to produce. Critics assert that natural rubber alone would be used in tires if the Government would permit, because of the tendency for GR-S to heat up more at high speeds and under heavy loads than natural rubber. This one great drawback of GR-S comes from imperfect resilience or elasticity and explains its lack of adaptability for use in heavy truck tires.

Step by step improvements are constantly under way. Most publicized is a recent announcement that it is now possible to make general purpose synthetic rubber at temperatures between 0 and 40° F., compared with the 122° temperature formerly used. This sharp reduction in production temperature has increased the rubber's abrasion resistance 30%, made it much more resistant to flex-cracking, improved its rebound, and reduced heat build-up under flexing, according to developers. Critics assert that the new process still doesn't give the desired amount of elasticity but is a forward step.

More than 50 varieties of GR-S are in production, and 72% of the total production has been tailor-made to meet special requirements. Three years ago it was said that processing disadvantages were costing the equivalent of 7¢ a pound. Today there is more talk about processing advantages such as cleanliness and uniformity, although it is generally admitted that the stronger and stickier natural rubber is sometimes easier to fabricate.

The methods for varying a butadiene-styrene type copolymer are multitudinous. For example, the conversion process can be stopped at a number of different points, and in each case a copolymer with

COURTESY BAKELITE CORP.

somewhat different properties is obtained. For tire type GR-S, the mixture is generally charged with 29 parts styrene and 71 parts butadiene, but polymerization is halted when about 70% of the mix has been converted. If halted at 60 or 65%, a material with slightly different properties is obtained. The residue is separated and used again.

There are 14 different GR-S types now produced under the Office of Rubber Reserve Corp. sponsorship. Even in this number there are wide differences. Variations in percentage of styrene and butadiene, as well as changes in modifiers, are numerous. GR-S-60, for example, is a combination of butadiene and styrene with divinylbenzene as a bridging agent. It has better tubing and molding properties with less nerve and shrinkage than standard GR-S, and it can be used with both synthetic and natural rubber to improve processing properties. GR-S-65 has a lower ash (fewer impurities) and therefore better electrical properties. Type III latex is 50% of each monomer with no anti-oxidant. It is frequently used for coating fabrics and belts, to stiffen fibers, or to mix with natural rubber latex. Two types of GR-S are sold to processors with carbon black included, which has never been done with natural.

The above gives only an idea of what can be done. Polymerizing temperature may be altered to change the character of the rubber. Modifiers, of course, increase the range of possibilities. Rosin may be used instead of fatty acid to increase tackiness; different anti-oxidants may be used to improve aging.

Stain resistant anti-oxidants are also available. Alum is sometimes used instead of salt and acid for coagulation to vary the type of compound. Oil-proofness and solvent resistance can be increased by adding a furane derivative polymer. When more butadiene is added, the rubber has better characteristics at low temperature. That may be one reason why the Russians are supposed to have developed an all-butadiene rubber. When more styrene is added, the low temperature qualities decrease, but other qualities improve. Less than 30% styrene would make a better tire tread at low temperatures but a poor tire at normal temperatures. The possibilities have in no sense been exhausted.

Synthetic has advantages over natural in aging and processing, plus the uniformity preferred for insulation. Wire coaters have asserted that they would pay a higher price for synthetic than for natural in

Hot water bottles were manufactured of GR-S during the war but are now preferred in natural rubber. Vinyl has made no inroads in this particular field

Wire coating with natural rubber latex. GR-S and vinyls are widely used for same purpose

COURTESY UNITED STATES RUBBER CO.

COURTESY BAKELITE CORP.

Light weight, colorful vinyl garden hose has bitten deeply into a market that was exclusively rubber's

order to use it for this purpose. Synthetic is frequently chosen in the boot and shoe industry because of its resistance to the effect of light. Asbestos sheet packing and rubber tile are said to be superior when made with GR-S. Battery manufacturers prefer GR-S for certain purposes. Some manufacturers prefer GR-S latex over natural for solutioning their tire cord; incidentally, the cost for imported natural rubber latex is greater than for natural in sheet form, but the cost for synthetic latex is no more than in dry form.

Unpredictable economics

On the other hand, there are items that presently seem to be satisfactory only in natural rubber. In addition to tires, natural is preferred for such flexible products as certain types of gaskets and auto accessories where it has an advantage due to its limited cold flow. Flexible tubing, vat linings of certain types, and molded motor mounts which require great resilience are often preferred in natural, but GR-S is not entirely shut out of these applications. The number of pieces in which GR-S won't be used is getting smaller every day, and economics will probably be the final arbiter of which goes where. In fact, the economics factor is the most unpredictable quirk in this entire field.

Vinyls are finding wide uses in passenger automobiles. In addition to upholstery and possibly convertible tops, it is also being used in the production of fender welting, weather stripping, wire covering, and kick plates

COURTESY UNITED STATES RUBBER CO.

As has been said, present concern is more with what these new rubber developments mean to plastics rather than to natural rubber. The vinyls in particular are involved, although molded items of all plastics are also in the picture.

The fundamental difference between rubber and plastics is that the former is vulcanized with sulfur. Sulfur is cheap and plentiful in comparison with the plasticizers used with plastics. After vulcanization, rubber is no longer a thermoplastic. There is considerable difference of opinion about what takes place in rubber when it is vulcanized but the process generally results in a thermosetting finished product with a minimum amount of shrinkage.

A plasticized vinyl is inherently less resilient than a vulcanized rubber. It would be impossible to make a satisfactory elastic band out of vinyl; it does not have the necessary elasticity—it won't snap back. It will come back eventually, but very slowly. But vinyl has its own advantages in that other materials can be incorporated to gain new qualities.

The outstanding qualities of each of these materials are listed as follows:

GR-S rubber: high tensile strength; good abrasion; flexible; good elongation; good dielectric properties.

Vinyl: high gloss, smooth or slippery (plastic feel); resistance to ozone, oxygen, etc.; brilliant color in comparison to a natural dark for rubber; good abrasion, good dielectric properties.

End uses

Floor covering may be used as the first end-use example for comparison purposes. Neither vinyl nor rubber has a clear field ahead, but there are plenty of authorities ready to wager that together the two materials will eventually drive nearly all other similar types from the market after prices for rubber and vinyl reach a slightly lower level. Rubber men with long experience in the floor covering field say that nitrile rubber-vinyl compounds are almost certain eventually to take over the lion's share of the high quality market and leave the lower cost market to asphalt combined with one of the high styrene-butadiene copolymers. Other experienced processors not in the rubber industry deny that nitrile rubber is a necessary ingredient for the high quality market.

The big rubber companies, all of whom are deeply

interested in floor covering materials, are blasé about any threat to rubber in this market, and have little to fear from a possible decline in the rubber tile market. They are all deeply involved in vinyl and high styrene-butadiene copolymers and whether or not the price pendulum, as distinguished from a performance basis, swings natural or GR-S rubber into or out of this market, they are "sittin' pretty."

It is pointed out that before vinyl is widely accepted there are still many problems that must be overcome. Shrinkage and adhesion difficulties, a tendency of vinyl to set up strains when it is molded, and various other compounding and processing problems still bother some processors, but there are also problems involved in other floor covering materials. The opinion is given that linoleum and asphalt will crack when laid over boards because they are not flexible—that the wax, oil, and acids needed in the compound tend to cause deterioration. Rubber flooring grips the feet—nothing slides easily over it. This property is perhaps welcome in a laboratory, on ships, or in some commercial operations; but housewives and the public in general want a more smooth or slick surface on which feet or furniture can be easily moved. Furthermore, the abrasion resistance of vinyl is higher, if the loading compound is carefully chosen, and, of course, color gives it a marked advantage over rubber. The latter generally contains carbon black and an anti-oxidant or stabilizer to prevent aging. Both of these prevent good color.

One expert says that even light colored rubber flooring wears out faster than dark colored because good aging has been sacrificed in order to get color. Still another type of vinyl-rubber flooring adaptable especially for airplanes and buses is sponge rubber cast on a thin vinyl sheet. The idea is to obtain a cushion that will withstand vibration. This type wouldn't be satisfactory for ordinary flooring because it gains resistance to abrasion by the "give" in the sponge—in ordinary flooring the abrasion resistance is determined by its hardness. A chair left in one position would make a dent in the sponge type flooring.

Coming along fast is another entirely different floor covering made by using a high styrene-butadiene copolymer with asphalt, rubber, or perhaps other materials. The copolymer aids in processing, acts as a reinforcing agent, and permits good coloring. Developers expect such floor covering compounds to be low in cost.

A divided field

To an observer trying to put together all the conflicting thoughts expressed about floor covering, it looks as though this is a good illustration of plastics and rubber dividing a field—but that plastics should have an edge if price is brought down.

COURTESY THE B. F. GOODRICH CO.

Rubber and vinyl are equally useful in protective sleeves, aprons, etc., for laboratory and shop wear

Rubber producers claim vinyl floor covering should eventually cost less than rubber if for no other reason than that it does not have to be vulcanized, but from prices thus far obtainable the vinyl material is certainly held at a premium in most cases. Rubber tile, installed, is quoted at from $6 to $10 a square yard. Vinyl tile is quoted all over the lot from $6.50 to around $13, although one company is now quoting vinyl floor covering in a roll at $2.75 a square yard. Ordinary standard gage, inlaid linoleum costs between $2.25 and $2.50 a square yard before laying. Apparently there is going to be a lot of price juggling in the field before it settles down, but there always will be wide variations in style and quality. The flooring field is still very new to vinyls. It has been estimated that less than 5% of all vinyl chloride resin production went into the flooring field last year, and not much more is earmarked for immediate consumption, yet producers claim that flooring may become the vinyl resins' greatest outlet.

Coated fabric upholstery for truck cab seats and simulated leather covers for basketballs and other balls is in almost the same category as floor coverings in a choice between vinyl and rubber. For truck seats vinyl has better abrasion properties, but critics claim it has more permanent set and leaves depressions in the driver's cushion; also, there is no plasticizer exudation with rubber and no color angle since dark colors are satisfactory. The job may eventually go to the man with the best price.

For use as a ball covering to replace leather, there

COURTESY GOODYEAR TIRE & RUBBER CO., INC.

Vinyl floor covering, shown on a ship's deck, is expected to take over a large part of the high grade flooring market

COURTESY B. F. GOODRICH CHEMICAL CO.

Illustrating a variety of methods of applying vinyl to diversified end uses is this array of extruded garden hose, molded heel, solution or latex coated fabric garment bag and umbrella, calendared sheet fabric, and baby pants of light weight sheet

is first a great prejudice to overcome in favor of leather. However, a recently developed vinyl covered basketball for use by professionals is reported in favor because it is slick—that plastic feel again —yet it can be grained to give grip. In other words, it handles nicely and slips off the fingers easily, yet can be controlled by the thrower. Rubber covers have been used on lower cost balls of all types for years but have not generally taken over in the high-price field. Perhaps the new basketball will lead the way. Paradoxically enough, vinyl covers are also a threat to the lowest cost line in this field, now dominated by pyroxylin coated fabric covers for balls.

To keep out rain

Rainwear has been a favorite field for rubber almost since the day of its discovery. Vinyls have eyed the market with envy and made some progress. Both materials are just about as rainproof as anything known, but they are hot because no air can circulate through them. Rainproof footwear seems safe for rubber for years to come because of its elasticity, but nothing is sure in this industry, as is indicated by the recent announcement of a vinyl overshoe for children. Natural rubber is still claimed to be superior for rainproof footwear, but, as mentioned before, GR-S is making inroads because it does not age so quickly under the action of light. Blends of the two are also in use.

All-rubber raincoats of the type worn by policemen, trainmen, etc., show no sign of suffering from invasion by plastics, but a vinyl raincoat for fishermen is said to be showing excellent possibilities because of resistance to grease, slime, and salt water.

Light weight coats of rubber-coated fabric have been sharply challenged by vinyls, and to a limited extent by polyethylene, in the form of light weight free film, generally about 4 mils thick. Fashioned for both men and women, they have transparency, color, and style equal or superior to rubber coated fabric. There are still fabricating problems in plastics such as sewing and heat sealing, but experience and improved technique will overcome them.

The business of getting into the rainwear field with more of either plastics or rubber will bring out a competitive battle of the toughest sort. There are already well established lines, and those individuals dependent upon this enterprise are not likely to run upon sight of a competitor. Furthermore, a Dept. of Agriculture survey purports to show that only 28% of the female population buy rainwear. Of that number, 29% prefer cotton; 15% prefer rayon; 8% prefer plastic; 5% prefer wool 5% prefer shiny material; 4% prefer rayon-cotton 1% prefer rubber. The cotton raincoat is that type often treated with water-repellent chemicals like Zelan which is a water soluble fatty acid derivative which when applied and baked reacts with cellulose to form a coating that repels water but does not close up the interstices; the treated fabric can breathe. If this survey is a true picture of the situation, rubber and plastics have a big educational program ahead of them to win more customers, and since their chief competitor is cotton, which is subsidized and use of which can be encouraged by high-pressure national politics, there is going to be difficulty in placing more rubber or plastics in this category.

The results of the same survey, however, indicate that women must buy other protective devices against rain if they don't buy raincoats. Umbrellas are an example. Some have been made of vinyl but with not too happy results so far; however, better heat sealing techniques and improved plasticizers may alter the situation although cotton competition would again be in the background.

Aside from its use in rainwear, plastics film offers

a wide range of possibilities without too much competition from either natural or GR-S type rubbers. Rubber must be vulcanized and does not offer the possibilities of transparency or pastel colors present in plastics. Rubber's film strength is weak in comparison with vinyls, and elongation of rubber is too great for successful use in most film applications—it stretches too far. In light film raincoats, for example, it would conform to the shape of the body and leave no space for air. Moisture also goes through thin rubber rapidly unless it has been hydrochlorized. A natural rubber hydrochloride film is being produced in large quantities by one rubber company; so far it has been limited largely to packaging film although the company asserts it is now in production for apparel. Critics claim that its light stability and aging characteristics are not of the same quality as vinyl; however, producers of hydrochlorized rubber insist it is a plastic and that they have simply used rubber as a base material just as cellulose acetate requires cotton linters or wood pulp as a base. The finished product, they say, has all the properties and characteristics of a thermoplastic resin. It can be heat sealed, molded, extruded, drawn, or used as a laminate for paper, other film, and metal foil. It can even be drawn down to a 0.0004-in. film that can be used as an economical decorative ribbon.

Other companies are working with rubber film projects which may be announced before the year is over. None of them have told what the constituents are, but it would be normal to expect that nitrile and natural rubber are playing a more important part in these than styrene-butadiene rubber.

Rubber latex and its continuing widespread use may also affect the film outlet. A father with experience cites his experience with babies as an example. He declares that two types of baby pants are needed—one vinyl and one rubber. If the panties are to fit over a diaper and not too tightly around the legs, vinyl is best—it is strong and tough; but if the need is for leakproof panties, all in one piece, they should be made of latex dipped rubber so that they will be elastic and fit tightly. Natural rubber is preferred because it has greater strength—it will stretch and come back snug around the child's legs.

In the mechanical services where temperature extremes are needed, vinyl is generally less satisfactory than rubber. Hot water bottles, cold packs, and bandages with rubber thread are examples. Medical instruments that will withstand sterilization, remain flexible, and have little cold flow are still preferable in rubber. Rubber bulbs that snap back quickly are desirable even if some way could be found to mold bulbs of plastic by overcoming the difficulty of removal from the mold.

Transmission belting is presently favored in a combination of rubber and fabric because of elasticity. Nitrile rubber shows signs of moving in. One company has announced a belt for power transmission containing a series of nylon cords covered with a synthetic rubber compound that will withstand heat and oil. Conveyor belts are now being tried in a combination of vinyl, rubber, and fabric.

Don't sell shoes short

The shoe market, once looked upon as a favored outlet for vinyls, has been slow to materialize, probably due to mistakes made several years ago when vinyl shoe soles were improperly compounded. They will outwear most other materials but in men's shoes have a tendency to crack after long wear; the customer complains although he has probably worn them longer than any other material. The cracking may be caused by brittleness after exposure to low temperature. However, don't sell the vinyl shoe market short; interesting developments are under way. There are numerous shoe applications in plastics already, and more are coming—far more than can be discussed here—but they are more competitive with other materials than with rubber. Currently, the greatest use of synthetics in this field is probably in another type sole made of synthetic rubber with a high styrene-butadiene compound used as a reinforcing agent.

Garden hose is one of the most striking examples where vinyls have already taken over a good part of the market. A rubber company official has been quoted as saying that vinyl will absorb 15% of the market in 1948. Some authorities think his estimate is low. In the first place, vinyl hose is light and clean (preferred by women), and as one experienced home gardener said: "No man should have a

Vinyl flooring is reported to withstand the action of rolling casters better than other competitive materials

COURTESY UNITED STATES RUBBER CO.

garden bigger than his wife can take care of." Rubber hose made without fabric has a tendency to balloon out under pressure. Vinyl hose has enough strength, but it too will balloon if the water gets oo hot. A combination of vinyl and nitrile rubber for garden hose is also a promising possibility. The price situation in vinyl hose presents an interesting trend. Twenty-five feet once sold for over $15 in comparison to rubber at around $5. Lately vinyl hose has been advertised at a price level more nearly equal to rubber hose.

Hard rubber moldings were forced to share the market with phenolics many years ago because of a short cure time. Now vinyls without plasticizers are showing signs of entering the field more energetically although the necessary high molding temperature and pressure set up strains in the finished product, in direct contrast to hard rubber which can be molded without strain. The Germans are reported to have molded vinyl chlorides with better success than Americans. The incorporation of nitrile rubber in vinyls may dissipate this problem, and, as the industry now knows, rubber mixed with phenolic has already opened a broader field to phenolic molding by improving impact strength.

Injection molded vinyl

To sum up the entire vinyl and rubber situation, one authority has said that where the volume of each part is small such as in grommets or distributor parts, injection molded vinyl can always beat rubber unless the vinyl has too much cold flow for the particular application.

In medium sized pieces, such as pedal pads for automobiles where four can be made of either material in one shot, rubber would be less costly, but a penny more per pad for vinyl would get color and added wear. However, an order for 2,000,000 pedal pads, which is of the size put out by automotive companies, would require a lot of pennies, and colored pedal pads won't help sell a car as much as flashy trim elsewhere. Therefore, much depends upon the number and size of pieces required. In floor mats, for example, which are made in large volume, plasticized vinyl would have to sell at from 15 to 16¢ a lb., in comparison to the present price of resin alone of around 33¢, in order to compete with rubber.

In many cases vinyl will be chosen for its utility or style even though there is a small price differential against it. One automobile is equipped with a vinyl distributor cap assembly boot because of the material's oil and ozone resistance. A vacuum sweeper's bumper parts and hose assembly could have been either rubber or plastic, but vinyl was chosen because it gave color and gloss and cost only one or two cents more per appliance.

Weather stripping around windows of automobiles will be rubber if the manufacturer wants black; if he wants color, it will be vinyl. But in fender welting, the fabric will nearly always be coated with vinyl in the future because rubber is not so well suited for the job.

Wire coating

In the wire coating business, tremendous outlet for both vinyl and rubber, GR-S rubber is cheaper but generally has to be used with braided fabric; vinyl can be used without the braid. Futhermore, there is every indication that nitrile rubber-vinyl compounds will become the most superior covering ever known for many types of wiring. Nearly all vinyl used during the war went for wire coating, largely in ships, but several factors, including cost, prevented its more universal adoption in civilian applications. Even so, wire coating was until recently the vinyl industry's largest outlet, and it is almost certain to maintain or increase its rivalry with rubber in this field.

Improvement continues

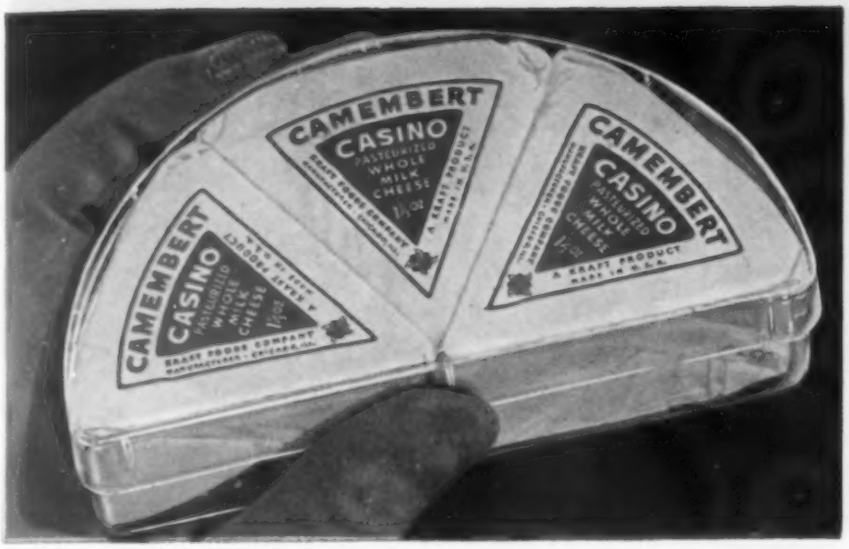
From all this, it is obvious that there are scores of places where vinyls, phenolics, and sometimes other plastics are going to lap over into the rubber market or be used in combination. Properties or quality will not always be the deciding factor—price will frequently be the final determinant.

And, above all, no one who is interested can afford to overlook the continuing improvement of synthetic rubber and plastics materials. It looks like a battle between chemists, and victory will go to him "who gets there fustest with the mostest and bestest."

¶ *Next month: Watch for a discussion on the part that high styrene-butadiene copolymers are taking in this unfolding of a new chemical front, together with the factors that make synthetic rubber of vital interest to the plastics industry from a raw material supply viewpoint.*

Rubber soles predominate in sports shoes; many of them are reinforced with high styrene copolymer resins. Vinyl soles show great promise but are being held back by temporary problems; interesting developments are coming

COURTESY UNITED STATES RUBBER CO.



COLOR PLATES COURTESY MONSANTO CHEMICAL CO.

Fig. 1: Packages cheese . . . has later uses

SOLD in Molded Plastics Packages

Every increase in competition for sales means that more products will be packaged in molded plastics. Case histories show why . . . and how

CLOSELY related to the sales economics of our times is the fact that the use of molded plastics in packaging has more than doubled since September 1945 and that much of the increase has come within the past eight months.

The pace of competition at point of sale is the reason for this progress. We are in a buyer's market as far as small unit commodities are concerned; so merchants want packages that will move goods by "impulse" or eye-appeal, that will have extra decorative and re-use value, and that will display well through color, form, and feel—the latter being important in self-service transactions. Also, there are 200,000 more retailers in the United States than there were in 1939, present total figures being 1,970,600, which is one store of some kind for every 71 persons in the census—and that's real competition!

This growing competition at retail is having its effect on packaging policies of manufacturers—and molded plastics are in! Literally everything from pencil leads to talcum powder, from cheese to watches, and from candy to mechanic's tools is put up in molded plastics packages today.

Historically, there's nothing new about the principle behind this progress. For more than two decades bottle caps and closures have been molded from phenolics and ureas. Molded, dipped, and blown cellulose packages have long been standard for many items. But the war-time developments of polystyrene and polyethylene made possible the recent expansion of the whole field—indeed, made possible kinds of packaging never available before. Two other factors contributed: techniques and equipment for producing large thermoset moldings such as the Marshall-White silverware chest featured in MODERN PLASTICS for February 1947, p. 96; and the use of plastics in combination with each other and with older materials.

Of course, a further reason for this new market was the post-war shortages of non-plastics materials. However, once a package goes to plastics it seldom leaves them; as other materials become more available, more and more plastics packages appear—to stay! For the reasons, let's look at some sample case histories, keying comment to the illustrations and to past references from this magazine.

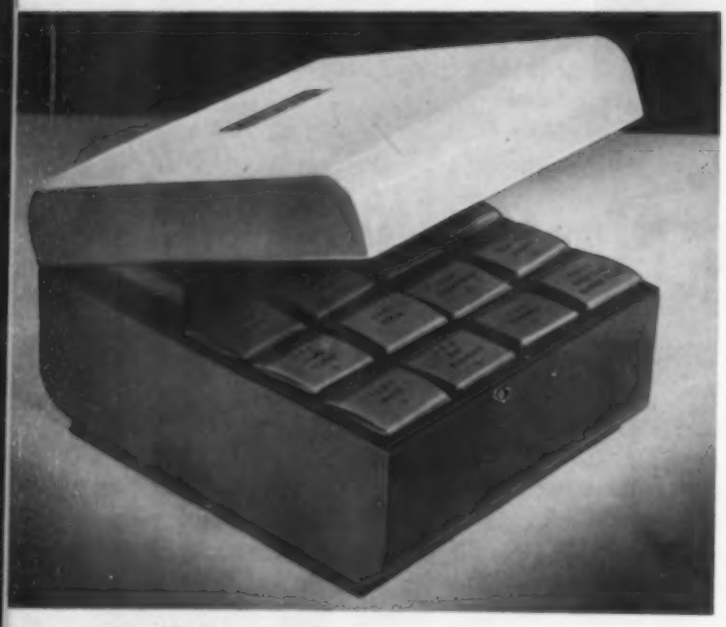
In foods, in soft goods, in apparel, and in candies, re-use packaging is far from new. Hickok put belts in fancy wooden boxes for re-use as cigarette boxes, but now uses plastics (MODERN PLASTICS, July 1947, p. 194) because of their permanent beauty. Kraft Cheese Co., having used tumblers to package cheese, recently continued the re-use theme by offering Camembert, a semi-luxury cheese, in a Lustron polystyrene package (Fig. 1)

SECOND OF A SERIES OF THREE ARTICLES ON PLASTICS IN PACKAGING

Fig. 2: Polystyrene replaces glass

COLOR PLATES COURTESY MONSANTO CHEMICAL CO.

Fig. 3: Tool package has many objectives



COURTESY GENERAL ELECTRIC CO.

Fig. 4: Stereoscope and films in one unit

COURTESY TENNESSEE EASTMAN CORP.

Fig. 5: Permanent protection

molded by General American Transportation Corp. The package becomes a trinket box or a fly-box for fishermen, adding a touch of permanence to luxury.

John H. Rice Corp. has put up candies in glass lanterns, automobiles, and locomotives for over a quarter of a century. Now (Fig. 2) the company turns to Loalin, another polystyrene, because it is more suitable for re-use as a toy, is capable of being molded economically into more accurate shape, and has a much lower shipping weight.

Another recent success in a plastic re-use package is a cottage cheese box featured in MODERN PLASTICS, March 1948, p. 164. Re-use as a refrigerator bowl is the obvious destiny of this box, because it nests readily, is chipproof, and is much more durable than glass.

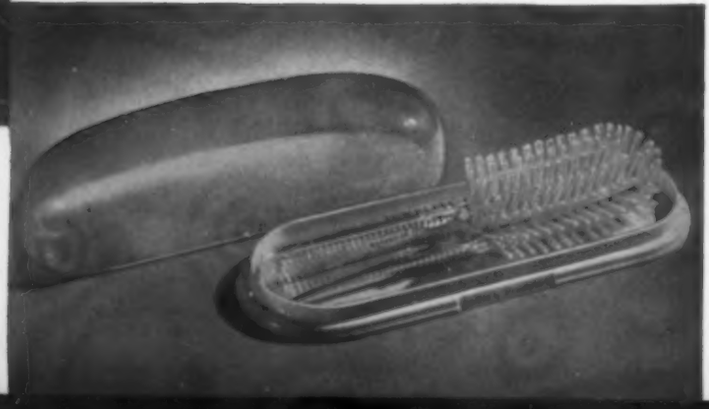
Permanent containers of plastics

When products are "hard" or durable, such as playing cards, tools, or cutlery, yet must be kept clean and in order, a molded plastic package is the natural choice. For example, the now famous red and black polystyrene box for Bruno auger bits, molded by aaRBee Plastic Co. (Fig. 3), makes tools look as beautiful as jewels, makes for strong display and ease of handling in hardware stores, makes for order and care in the workshop—and promotes gift sales.

The ivory urea lid and brown phenolic base of

Fig. 6: An all-plastics job

COURTESY AMERICAN CYANAMID CO.



COURTESY PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO.

Fig. 7: Like hand-carved ivory

COURTESY GENERAL ELECTRIC CO.

Fig. 8: Transparent and opaque

the box shown in Fig. 4 are molded by General Electric Co. for Tru-Vue Inc. to hold a modern stereoscope and a library of 12 film rolls. Durability and eye-appeal were factors in the choice of materials. The boxes, designed by Mast Development Co., are fitted to permit alternate use of them as cases for 20 films, eight filling the viewer compartment. Two dollars would be a modest retail price for such a box alone, but sold as a package with the viewer and films it costs the consumer only 49 cents.

Since extrusion is a form of molding, the fishing-rod container (Fig. 5), extruded from Tenite II by Extruded Plastics Inc., for Horrocks-Ibbotson Co., must be included among the permanent protective packages. The cellulose acetate butyrate tubes are 1½ in. in diameter and 3 ft. long, one end being covered with a cemented disk of Tenite, the other being stopped with a rubber plug.

Two plastics are used in the Pro-phy-lac-tic Brush Co. package shown in Fig. 6. The base tray is ivory Beetle urea formaldehyde, while the transparent top is formed from Vuepak cellulose acetate sheet. Since the brush and comb themselves are of transparent acrylic and the brush bristles are Nylon, this is an all-plastics job. The package protects the products and highlights their beauty in display.

Plastics presentation packages

Since timepieces were first made they have been presented with suitable words and gestures to relatives on anniversaries and business associates on great occasions. Recently they have been given new recognition as treasurable loot on audience-participation radio shows. Watches, jewelry, and fountain pens all are subject to purchase for presentation, so must be packed in durable, beautiful, and saveworthy boxes. Here molded plastics are taking over from leather-covered boxes which won't stand

Fig. 9: Trimmed and fitted with velvet

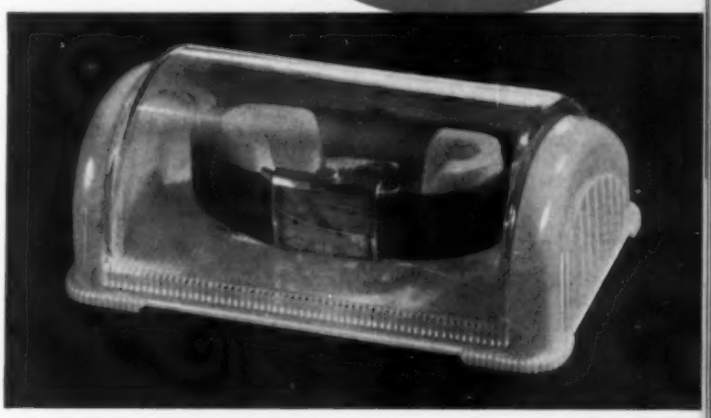


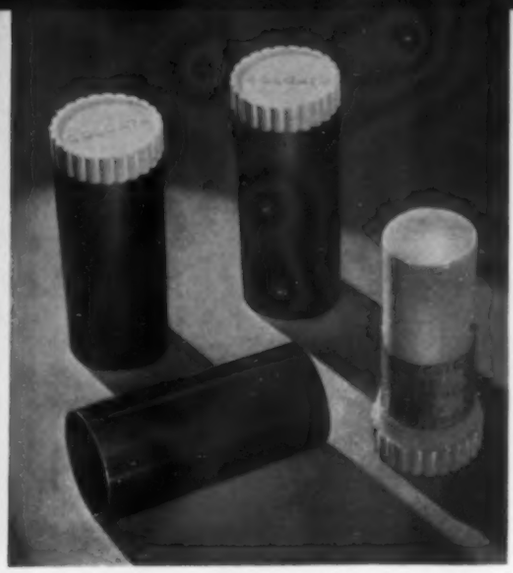
Fig. 10: Two-part display

Fig. 11: The color is gold

COURTESY AMERICAN CYANAMID CO.

COURTESY AMERICAN CYANAMID CO.

Fig. 13: Standard parts; wide design range



COURTESY DUREZ PLASTICS & CHEMICALS, INC.

Fig. 14: Plastic holds shave stick

...ow man hides perfume bottle

abrasion and from plated metal which will tarnish.

The Hamilton watch box (Fig. 7) is molded from ivory Plaskon urea with an antique finish rubbed in, making it look like hand-carved ivory. Ring boxes shown in Fig. 8 are molded for Dennison Mfg. Co. by General Electric Co. from cellulose acetate and polystyrene. The bases are transparent while lids may be white, coral, or ivory.

Ivory Lumarith is the cellulose acetate used to mold the Harvel watch box shown in Fig. 9. It is designed to display watches with either expansion bracelets or leather straps, and is trimmed and fitted with green velvet.

Standard Novelty Co. molds the two-part watch display box in Fig. 10 from Bakelite polystyrene. For Gruen watch packages, Rathbun Molding Co., uses Beetle in a unique gold color (Fig. 11) with the well-known Rathbun hinge.

Cosmetics offer opportunity

In the field of cosmetics, molded plastics made their first entry to packaging markets. Here the variety of requirements offers full scope for ingenuity and artistry in design and application. Material choice may depend on price, quantities, class of markets sought, and method of application as well as chemical content of the cosmetic.

Seasonal sales schemes for cosmetics create demands for such jobs as the foamed Styron snow man in Fig. 12, made by Schwab and Frank, Inc., which contains a 4-oz. glass bottle of Elizabeth Arren's "Flower Mist" perfume.

Lipsticks are, of course, almost a staple item in drug and variety stores. And plastics fell down badly in lipsticks during the war because of misapplication. A proper approach to the subject is il-

Fig. 17: Horn of bubble bath

COURTESY TENNESSEE EASTMAN CORP.

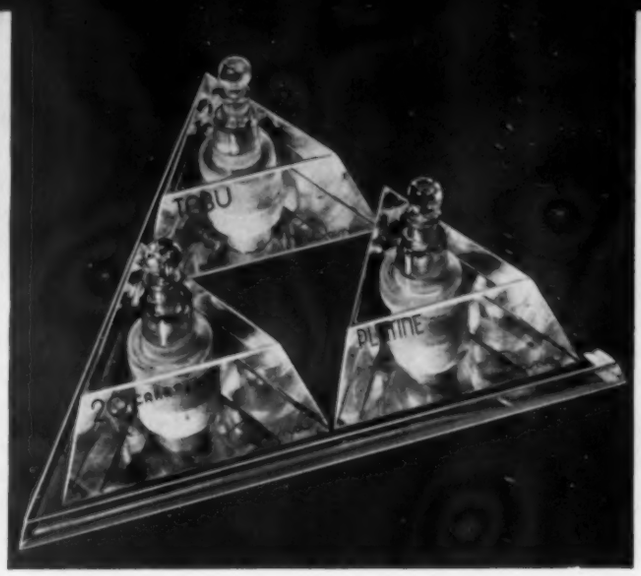
Fig. 18: Massive yet light

COURTESY BAKELITE CORP.

Fig. 19: Just squeeze it

COURTESY PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO.

Fig. 15: Can decorate the dresser



COURTESY E. I. DU PONT DE NEMOURS & CO., INC.

Fig. 16: Bottles lock into blocks

lustrated in Fig. 13. Harry Broder, Inc., uses a standard line of metal boxes, holders, and elevators with a variety of shades and colors of Beetle shells to provide a wide range of designs for various manufacturers.

There's something about the thermoset plastics that appeals to men. The Cargo gift box (MODERN PLASTICS, December 1946, p. 96) was an example of this. Another is the Colgate-Palmolive-Peet Co. shave stick (Fig. 14) molded from Durez phenolic with a black cover and a white base by Standard Molding Corp.

For some cosmetics, permanent containers are desirable. Others may require re-use packages. The Plaskon urea boxes in Fig. 15, molded by Plastic and Die Cast Products Corp., for Max Factor, can become dresser trays. Still others need presentation gift boxes, in the jewelry class. Figure 16 shows a Lucite perfume package set made by Charles Victor Co., for Dana perfumes. Bottles are made wider at the bottoms than at the top, to lock them into the plastic blocks, and empty bottles can be replaced by unscrewing the blocks.

The unusual is always wanted by someone in the cosmetics business. The "Horn of Loveliness" in Fig. 17 is a bubble bath container molded from Tenite I cellulose acetate by Wenco Co., for Kempton Paine, Inc. In use it may be hung by the cord from a hook or a towel bar, and the tight-fitting closure keeps the contents in. When empty it becomes a flower holder.

To achieve the massiveness of an opal face-cream jar, yet with less weight, and to insulate contents against damage by temperature changes, in storage, Colt's Mfg. Co., developed the packages shown in Fig. 18. They consist of outer jars molded from urea formaldehyde with matching caps, and inner jars of polystyrene.

Latest entrant to the cosmetic packaging field is polyethylene. Arguments concerning this material's ability or lack of ability to prevent the passage of essential oils from perfumes are numerous and loud: time will tell. It certainly can't be used to hold mineral oils. But it resists acids that will etch glass. And you can squeeze it!

The "Stopette Spray" bottle (Fig. 19) molded from polyethylene by Plax Corp. for Jules Montenier Inc., holds a liquid deodorant containing 25% salts, and makes use of the squeezability of the bottle to apply the deodorant. Three plastics are used in the package: the nozzle with its two 0.004-in. holes is machined from acrylic and forced into the neck of the bottle; a polyethylene tube feeds the liquid to the nozzle; the bottle cap is urea.

For powders, polyethylene "puff" bottles are rapidly taking over from other materials. (See MODERN PLASTICS, November 1947, p. 158). Seaforth men's toiletries use them also for shaving lotion, hair dressing, and cologne with much success. The bottles are capped with phenolic and save over 70% in container weight and 20% in space. While polyethylene is alabaster-white-translucent in color, the Seaforth line was color-matched to the company's regular tan glass bottle. (*Turn to next page*)

COURTESY TENNESSEE EASTMAN CORP.

Fig. 20: Color coded

Q -PINS
THE NEW "Q"UALITY BOB PIN
31 BOB PINS 10¢
NEW! EXCLUSIVE!
31 "SNAP-BACK" BEADED-END BOB PINS IN HANDY JEWEL-TONE, SPILL-PROOF CASE
See other side
Double Money Back Guarantee

Fig. 21: Tough problem solved

Some things just don't take easily to packaging at a given price or in a desired style. Other products must be offered in handy measuring containers to prevent waste or underuse. Some need coddling against temperature and humidity changes. A few are nasty and hard to contain.

Special problems involved

W. A. Sheaffer Pen Co., had a pencil lead packaging problem—one of coding for color, of easy opening, of cleanliness. The answer is seen in Fig. 20. This flip-top package has streamlined, rounded ends and a hinged lid and is molded in various colors of Tenite II by Injection Molding Co.

Bobby pins are handy for hair-do's and can substitute for screwdrivers, as every woman knows, but they're tough to package properly. Q Products Corp., is justly proud of its polystyrene packages (Fig. 21), molded by Robert Y. Grant, in two 40-cavity dies, one for the caps, one for the vials. One package and 31 pins, attached to a bright card, sells for 10 cents. Since women have trouble judging exact color through the plastic, one pin is attached directly to the card.

Badminton birds are examples of products that need careful protection: they must be kept in an atmosphere of constant humidity. Figure 22 shows how Clover Leaf Plastic Co., overcame the problem and incidentally opened possible markets in other fields. Extruded acetate tube, from Carter Products Corp., is fitted with a sealed-on base and capped with a molded polystyrene lid containing an absorbent wick and a water reservoir. Water vapor from the wick prevents the birds from drying out.

Polyethylene closures, according to enthusiastic experts, are the answer to many unsolved packaging problems. Don't be surprised to see molded polyethylene plugs replace wood-topped cork on liquor bottles, and at a saving! Acids, disinfectants, and other rude materials behave well for this new plastic. Figure 23 shows an interesting application in which a polyethylene closure with a hollow plug becomes a measuring device for a disinfectant.

Other new developments

In our May 1948 issue, p. 98, we showed how three non-competitive merchandisers use a single smart package. There will be more instances of this: mold costs are high.

Elsewhere in this issue (p. 116) is the story of the new Clearsite vials. Again, economy is the issue, linked with stock supply of standard sizes and colors.

Another new development permits multicolor application to urea and melamine flat or large-area moldings. What this will mean to makers of molded plastics compacts and large jar tops is anyone's guess—but it can mean infinite variety of design from simple stock molds.

Expect to see more use of stock molds and more stock molded plastics packages available.

Expect to see more products packaged in molded plastics!

Fig. 22: Humidified container

Fig. 23: Closure is also measure

COURTESY BAKELITE CORP.

Color-ARMORED TUBING

Cellulose acetate butyrate, extruded in seven colors over two sizes of metal tubing, is big news in the transportation field, in architecture, and in decoration

THERE are many places where nothing but a metal tube will do a given job. Hand rails and stanchions for buses, banisters for industrial stairways, shower curtain rods, bicycles and baby carriages, and tubular metal furniture are good examples.

In all such cases, regardless of the metal used, finishing or coating is a problem, because the finish is seldom as durable as the metal. If the tubing is steel it may be plated with copper, then nickel, then chrome. It shines—but the surface scratches, it wears, it sometimes peels, and it is subject to chemical attack. Or the steel may be coated with ceramics, in which case the finish will chip. Paint just doesn't stand up either. If the tubing is aluminum it may be anodized—but that finish also wears off.

Plastics coatings were the obvious answer to the problem, but only recently has an economical standard line of plastic-clad metal tubing been made available. It is "Rub-Bub" color-armored tubing, a product of Samuel Moore & Co., Mantua, Ohio, coated for Moore by Carter Products Corp., Cleveland. The two companies are co-applicants for patents, now pending. The coating, 1/32 in. thick, is Tenite II.

How coating is applied

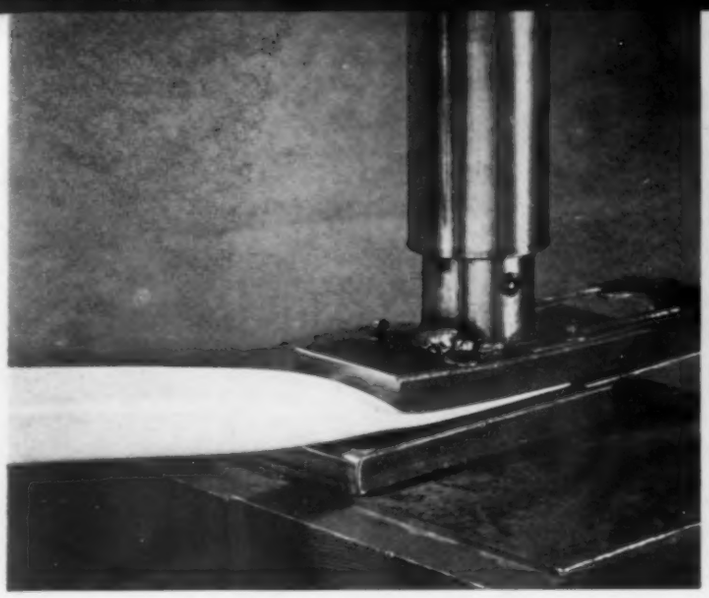
The coating is done by passing straight lengths of bare steel tubing through a cross head extrusion die. The tubing moves at a speed slightly faster than that at which the plastic is coming out of the die. Since the plastic is at a temperature of about 350° F., it shrinks on cooling. This, combined with the speed differential of the tubing, pulls the plastic down to

COLOR PLATES COURTESY TENNESSEE EASTMAN CORP.

Bare steel tubes are successively passed through a cross-head die where they meet the extruded plastic. Since the tubing is moving faster than the plastic is extruded, the resulting "skin" grips the tubing tightly

COLOR PLATES COURTESY TENNESSEE EASTMAN CORP.

Standard metal-working tools and machinery can be used to fabricate the plastic-covered metal tubing. Here a right-angle bend has been made and can be continued, if desired, to 180°. Producers of the covered tubing state that there are some tricks to be learned in certain operations but that the procedures, once acquired, do not slow production



One end of a section of color-armored tubing is flattened in a press; the cellulose acetate butyrate covering is not damaged in any way

A use for plastic coated metal tubing in the home is as a closet rod. Hangers will not mar the colored surface

the diameter of the tube. The result is a very strong friction grip of the plastic to the contour of the tube.

Immediately after one complete length has gone through the cross head, and while the plastic is still in a semi-molten state, the operator separates the leading tube from the one immediately following it. In a matter of a few seconds, the plastic has cooled sufficiently to permit handling.

The branded color armored tubing is weld seam steel, in two standard sizes: 1 3/16 in. and ⅞ in. outside diameters, both with 18-gage walls. Both sizes come in seven standard pastel colors. Literally any color can be provided, however, on minimum special orders of 25,000 ft. of tubing, and all special colors can be varied by adding metallic powders to the plastic. The company is also using the same process to apply different thicknesses and different plastic coatings to numerous sizes and shapes of tubing and rod made of various metals and even of wood.

The standard "Rub-Bub" coated tubing may be fabricated by sawing, bending, cutting, drilling, and flattening, without injuring or destroying the plastic finish. All of these operations may be accomplished by using standard metal-working machinery and standard tooling. Although there are some techniques to be learned in connection with fabricating, particularly bending operations, once such techniques are applied, they do not in any way hinder production. Largest single problem is that of joining pieces either at ends or at angles. For such joining, the Moore company has provided a group of standard fittings; where more specialized applications bring new joining problems the company undertakes to work out methods with the customer's engineers. By stripping off a piece of the Tenite skin, it is possible to weld the tubing and to thread it. Both metal caps and injection molded acetate butyrate caps are provided for closing open ends of tubing in decorative uses.

Standard fittings make it possible to join the protected tubing at angles, to suspend it, or to close ends

Development work on the product and process started late in 1942 and regular production came in at the end of the war. The company stocks about 250,000 ft. at Mantua for immediate shipment.

Tough service tests

For two years the plastic-armored tubing has been under field test in tough service. The Twin Coach Company, Kent, Ohio, has used it in seat grab rails, hand rails, and other places in buses and, having pioneered it, is now making it standard. In swimming pool ladder rails, in outdoor decorative fencing, and similar uses the tubing has stood up to all requirements. So tight is the fit of the plastic to the metal that no case of rust or corrosion of metal under the coating has ever been found, the company states. The tubing is not affected by water, salt air, hand perspiration, mild acids, or alkalies. It is electrically insulative. Tests have shown that the plastic skin will withstand over 15,000 volts. Any one of these qualities can be improved in special orders to meet specific requirements by changing the plastics or the thickness of the coating or both.

Markets for the product are under development

Baggage racks in buses are an important market for plastic covered tubing. An installation such as the one at the right requires from 400 to 500 ft. of the tubing

Colorful, wear-resisting footrests for buses are formed by bending lengths of the protected tubing

now. First is the field of public transportation where initial tests were conducted. Stanchions, seat grab rails, arm and foot rests, guard rails, hand rails, and luggage racks are the points of application. The amount of tubing per bus can be 700 ft. if baggage racks are included; 200 to 300 ft. if not. Since the price is much less than stainless steel veneer and competitive with chrome plate, it is no wonder that this market looks good. In 1947, for example, there were 20,064 common-carrier buses, 1008 trackless trolley buses, and 728 street cars made in the United States.

The transportation field also uses non-standard plastic coated tubing as antennas on railroad cars and rod material in buses for accelerator rods, hand brake rods, and front and reverse rods where uncoated metal would corrode and wear. Electrical systems of buses use plastic coated aluminum rod to replace copper in connecting batteries to ignition systems.

Furniture, display racks, baby carriages

Second field of application of the standard tubing is to replace chrome plate in metal furniture for beauty parlors, restaurants, and homes. Here the colors selected by Arleen Adams, colorist, are effective, particularly when used with vinyl upholstery goods.

Third field is in garment display racks for retail apparel stores. Fourth is in household and architectural uses—as shower curtain rods, closet rods, stair banisters, and towel racks.

Fifth there is the whole field of hospital furniture where cleanliness, warmth to touch, ease of cleaning, and color are advantageous.

Finally, a big market is foreseen in the baby carriage and infants' furniture field.

As for industrial applications where metal tube and rod with coatings resistant to acids, alkalies, electrical charge, corrosion, and impact are needed—Samuel Moore & Co. sees enormous possibilities for the product.

Plastic coated tubing can effectively replace chrome plate in furniture of the general type shown below

COLOR PLATES COURTESY TENNESSEE EASTMAN CORP.

Ample stocks of standard lengths and diameters of color-armored tubing are maintained at the plant of Samuel Moore & Co. Non-standard sizes and literally any color can be produced on special order. Unusual surface color-effects may be obtained by adding metallic powders to the plastic before it is extruded over tubes or rods

MORE MUSIC

Mass production of musical instruments helped by plastics

"If music hath charms to sooth the savage breast", plastic hath properties and production advantages to help make musical instruments available to more people at lower cost.

That more people are playing musical instruments today than ever before is obvious. Sales of musical instruments between June 30, 1946, and June 30, 1947, in the United States amounted to $101,513,830 against $28,391,450 in the previous 12 months. There are one or more musical instruments in over half the homes in the United States; a wind instrument is located in at least one home out of eight. Nearly

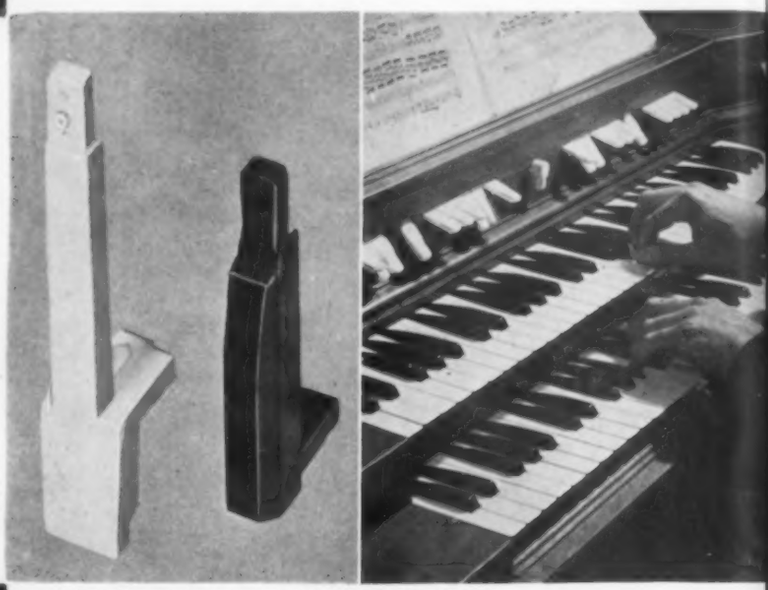


PHOTO COURTESY PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO.

Black and white organ keys (left) molded of urea are attractive, economical, and easy to clean. They are used on electronic organ (right) for schools, churches, etc.

every high school has its band, as have most grammar schools. Thousands of American Legion Posts, Service Clubs, Boy Scout Troops, and "Marching and Chowder" Societies have bands ranging in size from 30 pieces to 100.

As with refrigerators, automobiles, and radios, new and improved models of musical instruments are brought out every year, so a huge market exists for used instruments. This makes it possible for Junior, aged 12, to start learning on a $50 second-hand clarinet, and to advance to a $150 instrument when he has learned to play. Whatever instrument Junior plays, from an accordion to a zither, when he has a modern model he is using quite a bit of plastics.

Rollers for saxophone keys are machined from pearlescent cellulose nitrate. Automatic screw machines are used

The biggest instrument maker in the world, C. G. Conn Ltd., Elkhart, Ind., uses acrylic, ethyl cellulose, cellulose nitrate, vinyl, and urea formaldehyde as materials for molded and fabricated components in a wide variety of instruments. Conn put the manufacture of "music makers" on a mass production basis and plastics helped them do it. Plastics lend themselves to speed in molding and fabrication; a molded plastic part is much more economical than a metal part which requires 8 or 10 operations after being cut out from sheet.

Plastics' advantages

Besides the speed and economy of production, plastics offer beauty, smoothness of finish, ease of cleaning, strength, resistance to atmospheric change and to scarring or chipping, and the fact that the plastics selected for a particular assembly will produce no chemical reaction on plated surfaces.

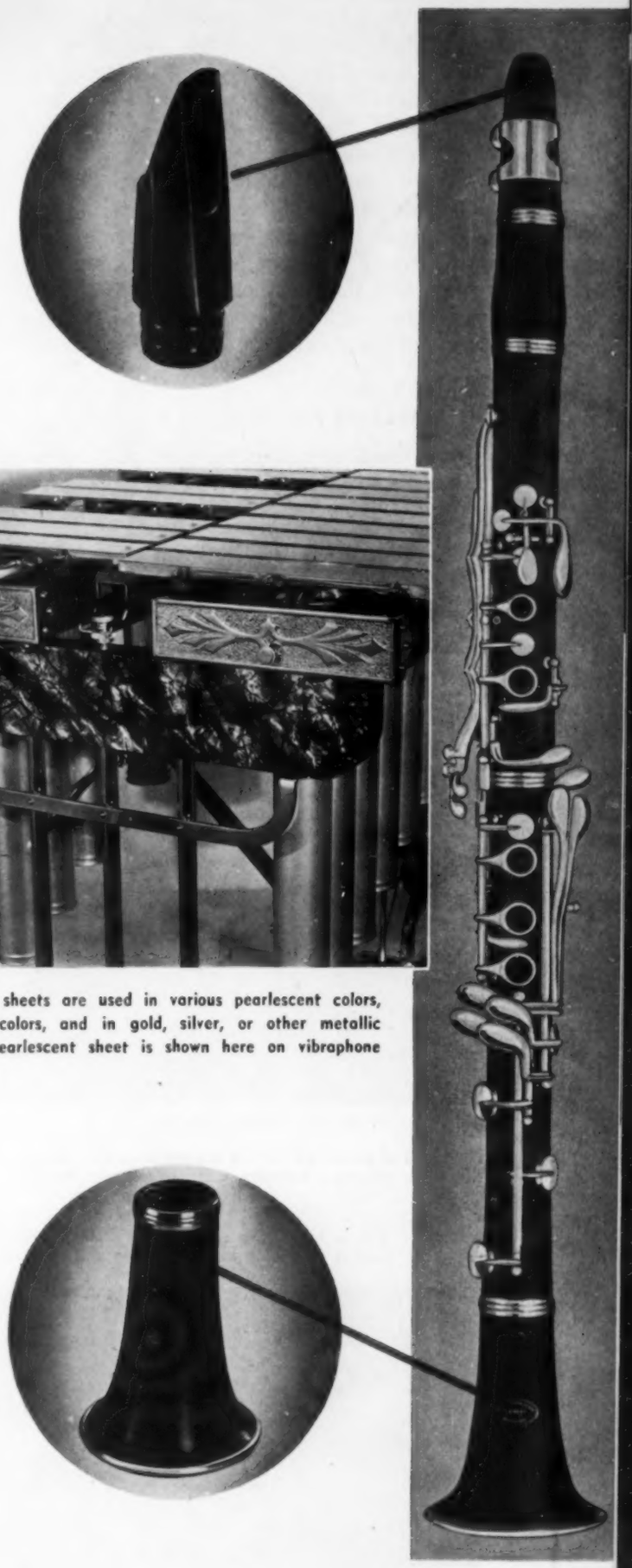
Conn follows a policy of supplying original molds to molding companies for the production of bells, mouth pieces, guards, and case plugs for their instruments. The molders then furnish finished and buffed parts. For example, a Lucite bell for a clarinet is molded by Sobenite Co., South Bend, Ind. Lucite reed instrument mouthpieces are molded by the Babbitt Co., Elkhart, Ind. Both mouthpieces for some instruments and case plugs are molded from Ethocel by the Sobenite Co.

Applications of cellulose nitrate

Rollers for saxophone keys are machined by Conn from pearlescent Pyralin, being cut to size, drilled, and finished on automatic screw machines. Cellulose

Drums are finished with white pearlescent cellulose nitrate sheets. Material was chosen for the application because of its beauty and resistance to damage

Cellulose nitrate sheets are used in various pearlescent colors, in bright plain colors, and in gold, silver, or other metallic effects. Black pearlescent sheet is shown here on vibraphone



Clarinet has injection molded acrylic mouthpiece (top) and acrylic bell (bottom). Some mouthpieces are molded of ethyl cellulose

nitrate sheet is used for valve protectors on cornets and trumpets, thus avoiding stain from perspiration. Sheet Pyralin is used on trombones to protect the players' collars. Drums and tom-tom shells are covered with sheet Pyralin. These nitrate materials come in different shades of pearlescent effects, in gold, silver, and other metallic effects, or in bright plain colors. The cut sheets are glued on the maple veneer of drums and tom-tom shells. The same sheet material is cut to fit the frames of marimbas and vibes. Conn states that cellulose nitrate has given them best satisfaction for these applications because of its permanent beauty and because of its resistance to damage.

Standard rod stock used

Handles and heads of mallets for marimbas, vibraphones, and glockenspiels are fabricated from cellulose nitrate by both Plastic Turning Corp., Leominster, Mass., and Keolyn Plastics Co., Chicago. The plastic is easy to handle in assembly and in component production, since standard rod stock is used.

Vinylite sheet is cut into strips by Conn and is used to replace strings for holding snares in place. Here the beauty of the plastic material and its strength and resilience are important.

An important large unit in Conn's production is the Connsonata, an electronic organ for use in schools, theaters, halls, and churches. It has Plaskon keys molded by General Electric Co. Urea was used here because of its beauty, uniformity of texture, economy, and ease of cleaning.

This group of applications represents no small consumption of plastics. The Conn company has a number of subsidiaries making different instruments and parts. The main plant alone employs around a thousand craftsmen, and has facilities for turning out more than 7000 instruments a month.

Laminated Fife

PHOTOS COURTESY PLASTICS DIV., GENERAL ELECTRIC CO.

Fife made of laminated plastics is light in weight and resistant to corrosion, humidity, and temperature changes

Fife is 15 in. long and 5/8 in. in diameter. Blowing aperture is formed of piece 2 in. long and 3/4 in. in diameter

FIFERS in such organizations as the fife and drum corps can now finger away on a new fife made from laminated plastics. Because of its true intonation and flute-like quality, it may prove to be more popular than conventional fifes.

This new instrument, known as the Boehmbore fife in B flat responds readily from C below the staff to the second A above. Made from General Electric laminated tubing by Leonard O. Merrill, Jamaica Plain, Mass., it consists of two main sections—the head and the body. To make the octaves come in tune, the head is reamed to a taper and finger holes are accurately drilled in the body of the instrument. A piece of laminated tubing 2 in. long and 3/4 in. in diameter forms the blowing aperture. This is slipped on the head of the fife, cemented in place, and spun to finish. The completed fife is 15 in. long and 5/8 in. in diameter.

In addition to its tone advantages, the laminated fife is resistant to corrosion, humidity and sudden temperature changes, is light in weight and durable.

Merchandising a Plastic Product

Above — Cold molded model building blocks featured in article were unpackaged, were sold in small volume by direct mail. Wooden windows looked unfinished. Blocks, scaled at 12 to 1, were quite heavy

Left — Same product, attractively packaged, is now sold in leading stores on tie-in with movie. Printed windows make models look real. Blocks are made on 20 to 1 scale to keep the weight of sets down

AN excellent example of the difference between merchandising a product and just selling it is the case of the cold molded model building blocks.

Henry Martin, who designed and developed the interlocking blocks, did not attempt to package them or to sell them as toys. Sales were mostly by direct mail order, and volume was small.

Last December an article on the Mebb blocks appeared in MODERN PLASTICS.[1] Among those who read the article was Paul Blaufox, a former motion picture publicity man who was looking for a plastic product which he could sell on a tie-in with the movie "Mr. Blandings Builds His Dream House." Blaufox got in touch with Martin.

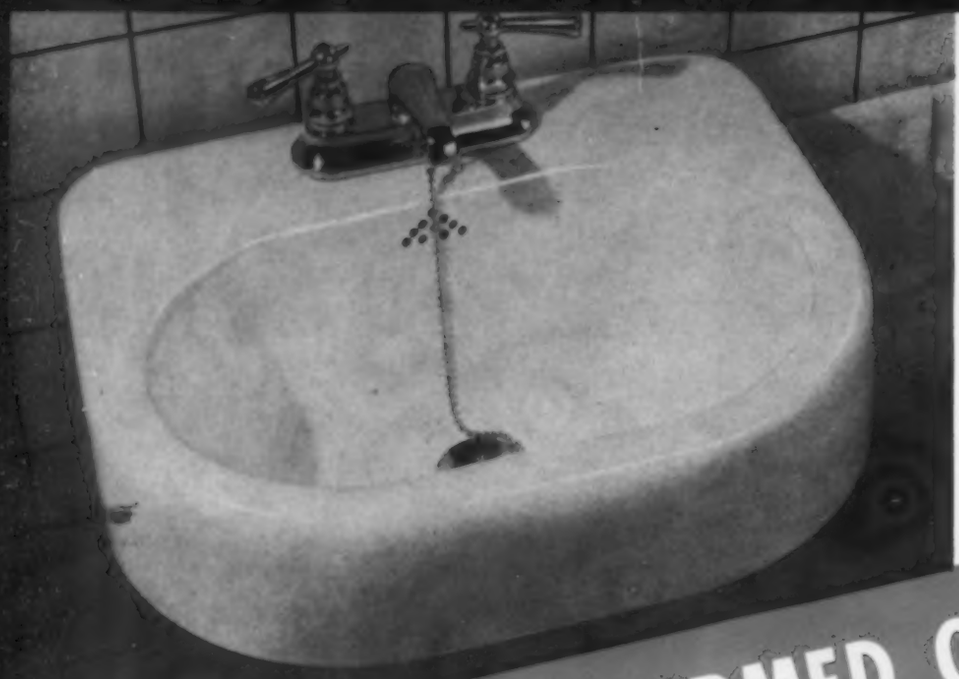
Some sample blocks and a scale model of the Blandings house featured in the movie were enough to interest the Selznick Releasing Organization. Blaufox got permission to use the name of the movie and pictures of its stars. He then formed Mebbs Educational Building Blocks, Inc., to merchandise the blocks.

The blocks are molded by Martin's company, Miniature Plastics, Inc., Lyndhurst, N. J., using Gladite, a cold molding powder made by Myler Plastics Corp., Jersey City, N. J. Blaufox buys the blocks in bulk, prints the doors and windows on cardboard, and packages the product.

A set of 600 blocks weighs 7 pounds. The resultant packaging problem was solved by a compartmented box made by Miro Container Corp., Brooklyn, N. Y.

To take full advantage of the publicity for the Blandings movie, the sets were put on sale when the movie opened. Additional sales promotion included: 1) giving some sets away as prizes on radio shows, thus getting the name Mebb mentioned; 2) window displays in leading stores; and 3) a television program on which a prize was given to the child who built the best house with Mebb blocks.

[1] "Cold molded model building blocks," MODERN PLASTICS, *25*, 100 (Dec. 1947).



Smooth compound curvatures, an attractive finish, and choice of white, pastel green, or blue are among advantages of this wash basin fabricated of acrylic

WASH BASINS FORMED OF ACRYLIC

A sheet of acrylic is being sawed in half here. Each piece will be used to form a sink modeled after the conventional type metal sink

An acrylic sheet, heated to the forming temperature, is placed on top of the plaster mold for drawing. This inexpensive plaster form was used to turn out sample sinks for determining the potential market

THE plastics industry in the United States has produced and marketed many bathroom accessories such as soap dishes, toothbrush holders, towel racks, and shower curtains, but it heretofore has been somewhat backward in fabricating pieces such as basins and sinks. On the other hand, the plastics industry in England undertook sometime ago the production of such fixtures, despite the fact that many producers in the United States considered these items to be unsuitable applications. Even though such plastic parts have been a commercial success in England, the major producers in this country still held the opinion that plastics should not be used for these purposes, either because of cost or of the unsuitability of the material itself. Many felt that the widely used abrasive household cleaning compounds would ruin the surface of such parts. They further held that if a drop of nail polish, for example, came in contact with a thermoplastic wash basin the finish would be ruined and indentations might even be made in the surface.

By paying scant attention to such propaganda, however, one small company, American Plastic Products, Co., Millburn, N. J., has set up a very profitable business producing and selling Lucite kitchen sinks and bathroom wash basins as fast as their equipment can turn them out. Although most of their techniques are not new, some novel procedures have been worked out to get completely smooth compound curvatures on sinks and wash basins.

How forms were made

In order to produce the first few rectangular sinks to test the market, an interesting and economical procedure was used in making the forms. It had been decided to duplicate the shape of a metal sink which was already on the market; hence an acrylic intermediate form was drawn using the metal sink as the master. Because vacuum was to be used to work the plastic sheet, several holes were drilled through the metal sink.

An air-tight chamber was then built around the bottom of the metal sink and a vacuum connection made to the chamber. An acrylic sheet of the proper size, after being heated to forming temperature, was clamped in place on top of the sink and then drawn to the exact contour of the inside. After removing the acrylic model thus formed, plaster was cast around the outside of it to make a female plaster forming fixture to the exact contour and dimensions of the inside of the original sink. After the plaster had hardened, it was trimmed and suitable vacuum holes were drilled.

When the sample sinks made from this inexpensive

Another view of the experimental plaster sink form. It was cast from an acrylic intermediate form drawn over a "master" metal sink

Clamps on the temporary mold hold the acrylic in position during the drawing process. In the final mold a vacuum will be used on the under surface; air pressure on the top

After the wash basin is removed from the bronze die, an operator saws off excess material to produce uniform edge

The next step in assembly is the drilling of a drain hole. Here a fly cutter mounted in a drill press does the job

A second formed acrylic part is glued on the bottom for overflow. Special jigs hold it in place until adhesive sets

plaster form were shown to the plumbing industry, the immediate reaction was: "When and how many can you ship to us?" Basing their decision on this favorable reception, American Plastic Products, Inc., decided that there was a market for such acrylic fixtures and proceeded to develop a wash basin to supplement the sink. Forms for these basins were originally produced from wood, but a great deal of engineering development was required before salable parts could be produced. Even after the engineering details had been worked out, it was found that the speed of production from these wooden forms was slow.

At the beginning of each day's work the wooden forms were cold and the first two or three parts would cool to rigidity in a reasonable length of time. However, as the forms began to heat up, the cooling time increased until nearly one hour was required before the finished part could be released from the form. This long cooling period also induced some blistering. Further, the wooden forms had to be greased before each forming operation, a messy job in itself and one which also necessitated later removal of the grease from the formed parts.

Bronze die used

Now the company has developed a bronze die which is cored to permit circulation of a cooling medium. It makes use of a vacuum to operate on the under surface of the basin and air pressure on the top surface. It has been found that both pressure and vacuum are required in order to draw a perfect bowl. An added feature of this die is that it makes use of mechanical pressure to produce the skirt of the basin. Another departure from standard practice is the use of radiant heat for softening the sheet stock before forming. With the bronze die, the forming cycle has been reduced to about 10 min. and the greasing operation has been eliminated.

A second formed part of acrylic is required to complete the wash basin. This shaped piece, cemented in position at the bottom of the basin to form the overflow, is held in place by means of a special jig until the adhesive sets. The adhesive used is not a standard acrylic cement, but its exact composition cannot as yet be disclosed.

Tests in service

According to the producers, the sinks and wash basins described will be furnished in white and in pastel shades of blue and green. One of their basins has been installed in their own plant for about six months for testing purposes. It is stated that as yet there is no indication of any scratching of the Lucite surface even though it has been repeatedly scoured with abrasive type household cleansers. Furthermore, they report that the basin has been subjected to the action of products normally found in home medicine cabinets with no apparent effect on the appearance or functioning of the fixture.

Hyatt Award Presented

ON May 25th, 1948, John D. Cochrane, Jr., director of research and development of the Formica Insulation Co., Cincinnati, Ohio, was presented with the seventh John Wesley Hyatt Award. The presentation of the Hyatt gold medal and one thousand dollars was made by President Harry S. Truman at a ceremony at the White House.

The Hyatt Award, sponsored by Hercules Powder Co., to honor John Wesley Hyatt, who developed Celluloid in 1857, was presented to Mr. Cochrane for outstanding work in the development and improvement of decorative laminates. Under the conditions of the Award, medalists are selected on the basis of the practicability of their achievements, the effect of these achievements upon the plastics industry, their probable future value, and their degree of originality.

John D. Cochrane, Jr.

As a result of Mr. Cochrane's work on laminates, he has developed inlaid designs, wood surfaces, solid colors, and laminated panels which are proof against cigarette burns. It is estimated that these developments have opened up markets which now amount to an annual sales volume of $20,000,000.

Born in Trenton, N. J., Mr. Cochrane attended Trenton High School and was graduated from Massachusetts Institute of Technology in 1923. After a year as a laboratory assistant at M.I.T. he joined Formica as a project engineer and initiated his first work on decorative laminates in 1927. When this work started, existing laminates were used primarily for industrial applications where appearance was secondary to performance. In order to achieve non-industrial uses—a huge potential market—new techniques and new resins were required.

Prior to 1931, laminates could be produced only in drab colors or black and brown. When the new thiourea resin appeared in 1931, Mr. Cochrane seized upon it as a material which would make possible the production of white and brilliant colors in decorative laminates. As a result of the succeeding development work the laminating industry began to grow and to become more diversified until today it is an important and stable unit of the plastics industry.

The next major step in the progress of laminates was modification of the melamine resins which proved to be ideally adaptable to the production of decorative and graphic stock. Continuing research by raw materials suppliers in cooperation with Mr. Cochrane made possible new and improved melamine resin formulations suitable for solid color production by 1947.

Mr. Cochrane is a member of Alpha Chi Sigma, national professional chemistry fraternity; Tau Beta Pi, national honorary engineering fraternity; Masque, M.I.T. honorary dramatic fraternity; Sigma Xi, national honorary research fraternity; the Cincinnati Engineering Society; the Aircraft Owner's & Pilot's Association; and the Kiwanis International.

Members of the current Hyatt Award committee are: George H. Clark, president, Society of the Plastics Industry; Charles A. Thomas, president, American Chemical Society; Charles F. Kettering, vice-president, General Motors Corp.; Dr. E. R. Weidlein, director, Mellon Institute; Dr. John J. Grebe, Dow Chemical Co.; Dean Richard F. Bach, Metropolitan Museum of Art; and Dr. Gerald Wendt, editorial director, Science Illustrated.

Rigid

Polystyrene and polyethylene containers made by new process offer many advantages over glass

A VIRTUAL revolution in the field of transparent packaging has been precipitated by the introduction of a new line of rigid polystyrene and flexible polyethylene containers which are available from stock in a wide range of diameters, lengths, and colors. The Clearsite vials are molded by a new process which has been in development for over two years in the laboratories of the Celluplastic Corp., Newark, N. J.

The new polystyrene vials offer packagers crystal-like transparency, rigidity, and greater durability than the familiar flexible solvent-molded cellulose acetate containers—at prices lower than those of the solvent molded vials. In addition, the Clearsite vials offer numerous advantages over glass.

Economical to ship

The plastic vials may represent a substantial cost saving because they are less breakable and lighter in weight, and therefore less expensive to ship. The vials are about 70% lighter than glass and additional savings in shipping weight are possible because no padding or bulky packing material is necessary.

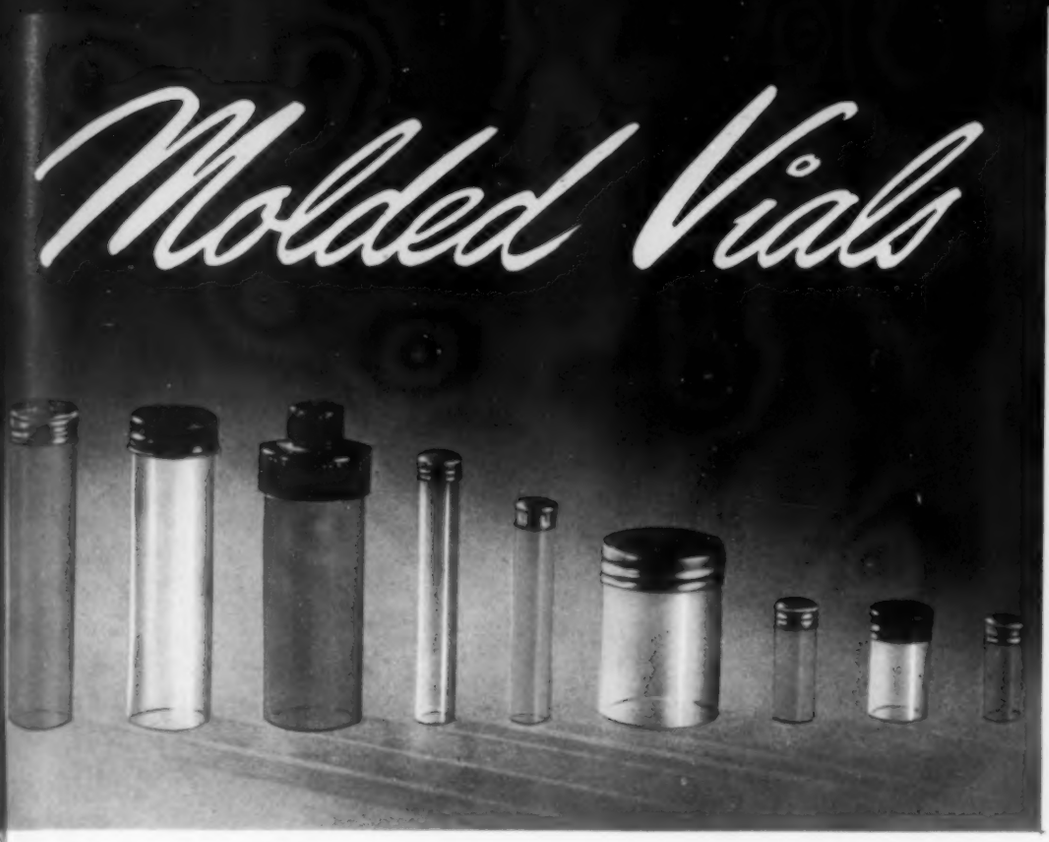
The use of polystyrene as a material opens almost unlimited color possibilities. In addition, the inherent qualities of the material make the vials resistant to alkalies, alcohol, and weak acids.

Another important advantage of the vials is the fact that they are available already labelled, and therefore need no paper labels. Celluplastic can imprint the labels in from one to five colors and the printing, which is done in the process of manufacture, becomes an integral part of the container.

The polystyrene containers are also more uniform in size than glass vials, and therefore can more easily be used with automatic packaging machinery. Filling or emptying the vials is facilitated by the fact that all inside walls are smooth, even where the

Colored labels are imprinted on clear vials used to package drill set (left) and mouthpiece for reed instrument

Molded Vials



Stock line of transparent polystyrene containers can be used with a variety of closures. Sizes range from ⅜ to 1¾ in. in diameter and from 1¼ to 6⅝ in. in length. Transparent green, blue, amber, and clear vials are stocked; other colors are available on special orders

outside walls are threaded for screw-type closures.

The Celluplastic Corp. is stocking the new polystyrene vials in diameters ranging from ⅜ to 1¾ in., and in lengths from 1¼ to 6⅝ inches. The vials are available unthreaded for use with a plug-type closure or friction cap, threaded for screw-type closures, or with a shoulder for seating an outside-fitting friction cap. Some of the sizes and closure possibilities are shown in the accompanying photographs.

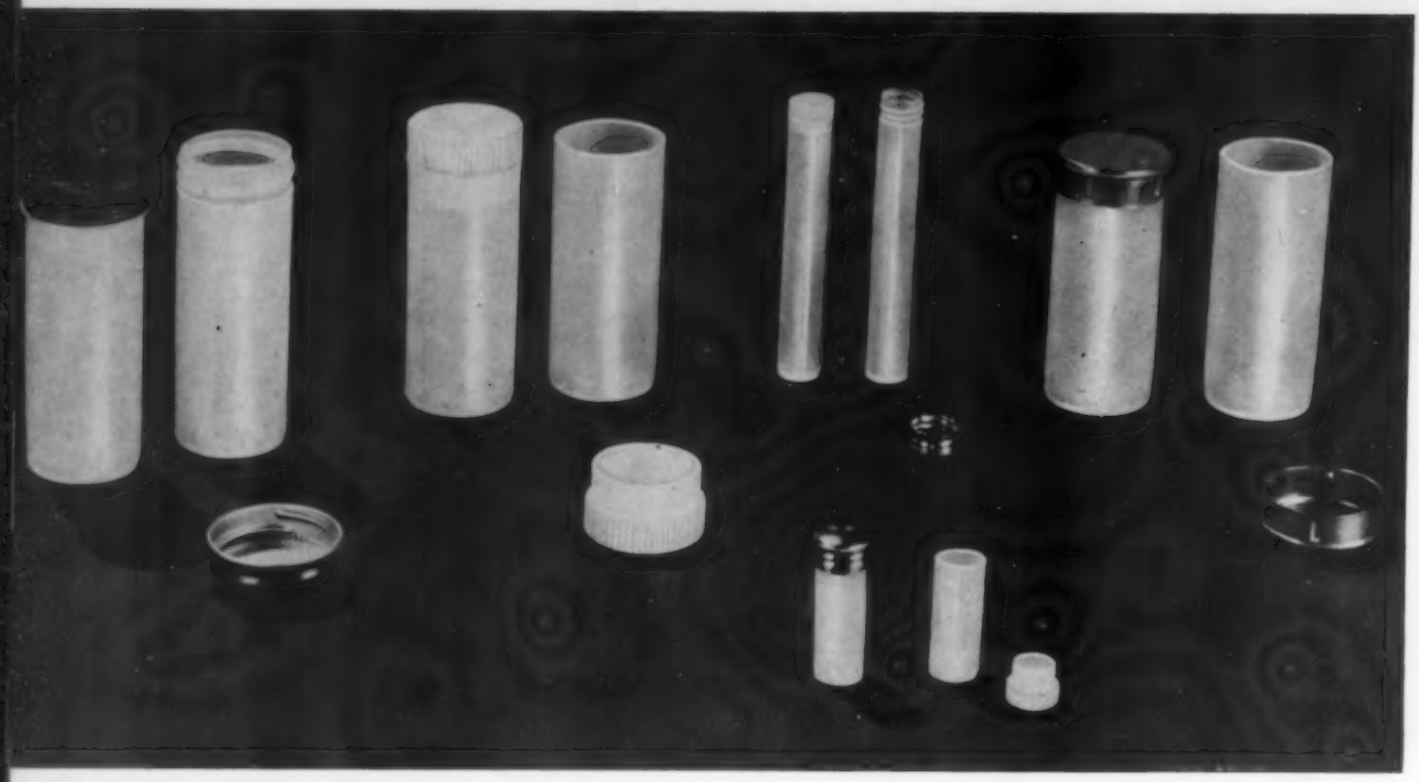
In its stock line, Celluplastic carries transparent green, transparent blue, transparent amber, and clear polystyrene vials. In addition, flexible polyethylene containers are available in the natural color.

On special quantity orders, the company can also supply polystyrene or polyethylene containers in other colors, transparent or opaque. Vials molded of other thermoplastic materials are also available on order.

The polyethylene vials can be combined with specially designed molded tops and closures to make squeezable dispenser type containers for either liquid or powders. One such liquid dispenser (shown at left in an accompanying photograph) has an opening designed to dispense the contents one measured drop at a time.

The newly introduced Clearsite polystyrene vials

Typical applications of the new polystyrene vials in the drug field. The products are styptic pencils, mineral and vitamin pills, and styptic powder. Plastic vials are lighter and less breakable than glass, therefore can be shipped more economically



Polyethylene vials, available in same sizes as the polystyrene containers, can be used for packages where flexibility or high chemical resistance is an important consideration. Screw-type, plug-type, or outside fitting friction closures can be used

have already been adopted by a number of packagers. In the drug field, they are being used for Vi-Syneral vitamin and mineral pills, made by the U. S. Vitamin Corp., New York., N. Y.; the Mammoth Styptic Pencil, made by the Woltra Co., Inc., New York, N. Y.; and for styptic pencils and styptic powder distributed by Eagle Druggists Supply Co., New York, N. Y.

The adaptability of the vials to the packaging of items outside of the drug field is illustrated by two other applications. The Woodwind Co., New York, N. Y., is using the large size vials to package its line of mouthpieces for reed instruments. In the tool field, the vials are being used for the Yankee Handyman drill set made by North Bros. Mfg. Co., Philadelphia, Pa.

Specially designed molded tops can be fitted on polyethylene vials to make squeezable dispenser type containers for liquid (left and center) or powder (right). Two closures shown are molded of phenolic; one (center) is polyethylene

Vinyl Tube Aids Physicians

AS medical men become more familiar with the properties of plastics and the ways in which these materials can be fabricated into complex shapes and forms, they are finding them increasingly useful. Among the latest medical applications of plastics is a 10-ft. double-lumened (two channels or openings) vinyl tube used in intestinal treatment. It is 6 mm. or 0.23622 in. in diameter—just under ¼ inch. The small hole at the side (in cross-section) is roughly 1 mm. or 0.035 in. in diameter. The tube is punctured near the end with several lateral holes approximately ⅛ in. in diameter so that suction can be used to decompress the small intestine.

The tubing is extruded by Jessall Plastics, Inc. of Hartford, Conn., and the completed unit is manufactured and distributed by Payette and Henning, Inc. of Wyandotte, Mich. This tube is made of a vinyl compound especially developed for Jessall with a common non-toxic plasticizer and other materials added to make it radiopaque so that it may be observed under fluoroscope or X-ray.

The entire unit—tube, balloon, and fittings, as shown in one of the illustrations—is known as the Honor-Smathers Tube. It is used largely for decompression of the small bowel in cases of peritonitis, strangled hernia, intestinal stoppages, and similar afflictions.

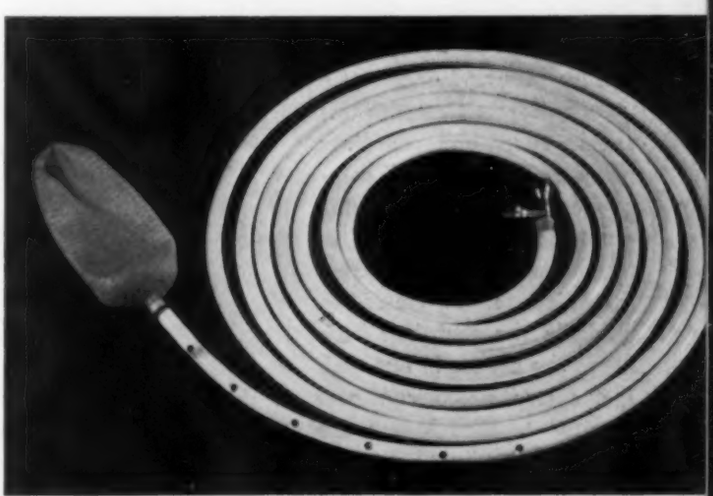
It was developed by Drs. W. H. Honor and Homer M. Smathers, in collaboration with Payette and Henning, Inc., in their search for an ideal tube that would have two lumina, one large for the aspiration of intestinal content, and one small for the introduction of air into the balloon. They wanted a tube flexible enough to follow the contour of the bowel easily, yet rigid enough to prevent kinking or collapsing on suction. It had to be non-toxic, opaque to fluoroscopy, and easily introduced into the gastro-intestinal tract. No material other than this special vinyl compound fulfilled all these requirements.

The method of use is to insert the tube and balloon containing 2 cc. of mercury through the nostril with the patient supine. The mercury weights the balloon and pulls it into the pharynx, after which the patient is instructed to sit up and swallow. Air is then forced through the small tube opening to inflate the balloon so that peristalsis may carry the balloon and tube down to the point of obstruction. Suction is maintained throughout this period.

Doctors say this tube has been more satisfactory than any other used, primarily because of its ease of introduction, and effectiveness and rapidity of decompression. There have been no instances of ulceration even though the tube has been in place as long as 35 days. Patients who are allergic to rubber are not affected in any way.

The biggest problem to the extruder of this tube was building a die that would insure producing a round hole which would not become elliptical. In all other types of tubing the tube walls would squeeze together and close the opening when a vacuum was pulled. Another problem of extrusion was a tendency of the tube to curl upward as it left the die due to the slight ridge-like structure on the side of the tube where the minute air channel is housed. Special die construction, plus the proper flow compound, was finally achieved after four different dies had been made and eight 200-lb. barrels of different formulas were tried. The tube is extruded at as low a temperature as possible—about 300° F. at the die.

Vinyl tube has large hole almost ¼ in. in diameter and small hole (above pencil point) with 0.035-in. diameter



Tube is punctured near the end so that intestine can be decompressed by suction. Mercury is used to weight balloon

PLASTICS PRODUCTS

For those who don't like the taste of the adhesive on stamps or labels, this polyethylene letter moistener is ideal. Flow of water from the tube is controlled by a pressure - activated plastic valve. Thus water cannot wet the foam rubber sponge or leak out on the desk when moistener is not being used. The Hydrawlik Co., 131 East First Ave., Roselle, N. J., molds the moistener of Bakelite polyethylene and markets it as a proprietary item

Bulletlike lines and bright colors of this Daytona model racer make it a sure winner with youngsters. Molded of Tenite cellulose acetate, the racer can take bumps and rough handling without breaking. Propelled on outsize rubber tired wheels by a wind-up motor, it is suitable for tether racing; holes are provided for lines. Molded by Peerless Molded Plastics, Inc., Toledo, Ohio, for Black Industries, 1400 East 222nd St., Cleveland 17, Ohio

Cheese serving and storage problems are solved with this cheese slicer and container made of Koppers PB 7 polystyrene. As this plastic imparts no odor or taste to food, it was considered ideal for this use. A molded-in guide in the container base keeps the cheese in line with the cutter which can also be used to slice butter, ice cream, and other soft foods. Molded by Stewart Plastic Products Co., for Tapco, Inc., both of Springfield, Ohio

The soft ivory color and quiet decor of this holy water font are in keeping with its religious nature. Injection molded of ethyl cellulose in a three-cavity die, the font consists of a top cover, front section, and joint back and bowl section. Because of Celcon's light weight, it can be easily suspended from wall or picture molding. W. & A. Co., Attleboro, Mass., molds this housing for the Jewel Cross Co., Inc., North Attleboro, Mass.

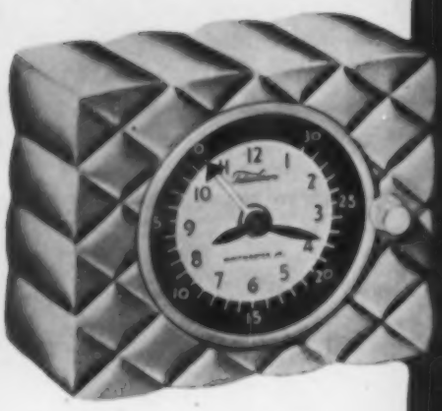
Matching lampshades and draperies are now feasible, thanks to a process developed by Phil-Mar Shade Corp., 1809 East 22nd St., Cleveland 14, Ohio, by which a fabric is laminated onto a Fiberglas-plastic base to form a lampshade. Known as the Glastron Fabric Series, these shades may be washed without danger of stretch or shrinkage, are fire-resistant, attractive, and durable. They are expected to find ready acceptance in homes and hotels

This new lighting fixture uses light, translucent Lustron in two edge tubes and in the "egg crate" diffuser. Molded by Bernard Edward Co., 52 and Wilmer Ave., Chicago, Ill., for Leader Electric Mfg. Corp., 3500 N. Kedzie Ave., Chicago

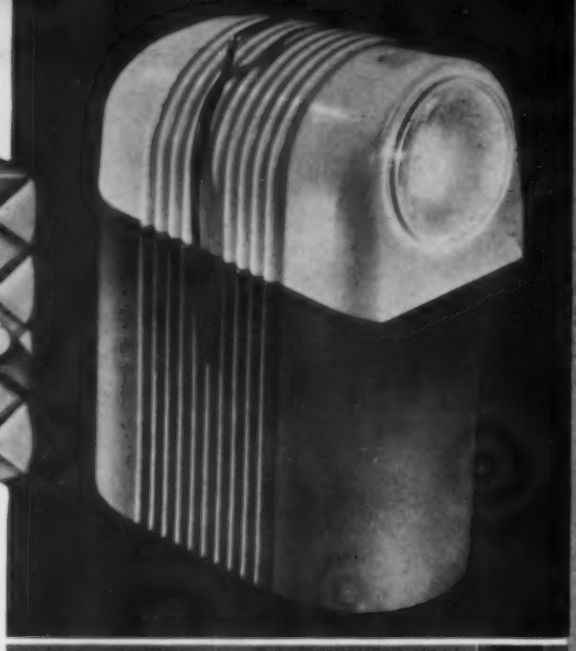
This vinyl shopping bag measures 17 by 17½ in. and will carry a load of 40 pounds. But when it is empty it can be folded to purse size (9 by 6 in.). There is also a convenient zipper compartment for money, papers, and the other usual contents of a purse. The bag is fabricated of 22-gage vinyl in reptile, calf grain, brown, navy, maroon, or red. It is manufactured by Abe Cohen, 40-04 National Ave., Corona, L. I., N. Y., using Du Pont vinyl

This new phenolic dispenser can hold a single roll of adhesive labels up to 1¼ in. wide, or two rolls totaling 1¼ in. or less. With this dispenser, an operator can easily label small items using only one hand. Manufactured by Avery Adhesive Label Corp., 36 West Union St., Pasadena 1, Calif.

To warm baby's food or bottle, or to heat a potato or egg, the Electresteem Baby Chef is convenient and safe. The molded phenolic housing can be submerged in water without damaging the electric heating element. The special construction of the Resinox walls keeps the outside cool enough to handle no matter how long water is boiled in it. A special switch turns off the heat automatically if water boils out. Made by Electric Steam Radiator Corp., Paris, Ky.



Two useful kitchen tools, the electric clock and the timer, are combined in this Minitmaster, Jr., made by Telechron, Inc., Ashland, Mass. Heat-resistant Beetle was selected for the housing of the clock so that it could be used safely on a stove. The case is molded by the Waterbury Companies, Waterbury, Conn.



Both the case and the magnifying lens of this pocket-size flashlight are plastic. The two-part case is molded of cellulose acetate, and the lens is clear polystyrene. The flashlights are made with red acetate tops and white bottoms, or vice versa. The three plastic parts are molded by Connecticut Plastic Products Corp., Waterbury, Conn., for W. C. Burroughs Co., Inc., Winsted, Conn., which makes the lights

A professional window washer may not mind splashing water on other people's window sills. But housewifes prefer to do the window washing chore more neatly. They can do the job quickly and easily without pails or wet rags if they use the new Dee Dee Window Washer. This device automatically feeds water from the hollow handle into a felt blade. The washer is molded of cellulose acetate butyrate by Worcester Molded Plastics Co., Worcester, Mass., for National Housewares Co., located at 170 Admiral Road, Buffalo, N. Y.

Hostesses who are serving tea, snacks, or light lunches can make use of new trays molded of high heat-resistant polystyrene. The trays are available in ivory, green, blue, red, black onyx, or walnut. Lustrex was chosen as a material for the trays because it is light, durable, and will stand washing with hot water. Molded by Rogers Plastic Corp., North Wilbraham, Mass. Each tray comes packed in an individual dustproof cellophane envelope

Versatile is the word for this vinyl air mattress. It can be taken on picnics, kept in the closet for extra overnight guests, or even used at the beach as a surf-rider. The tufted design gives it rigidity. It is light easy to carry, compact, and the container serves as the pump. Only a few strokes will inflate the mattress. All tufts and seams are electronically heat sealed. The Float-O-Mat is made of Vinylite by the Hedwin Corp., Baltimore 11, Md.

PLASTICS PRODUCTS

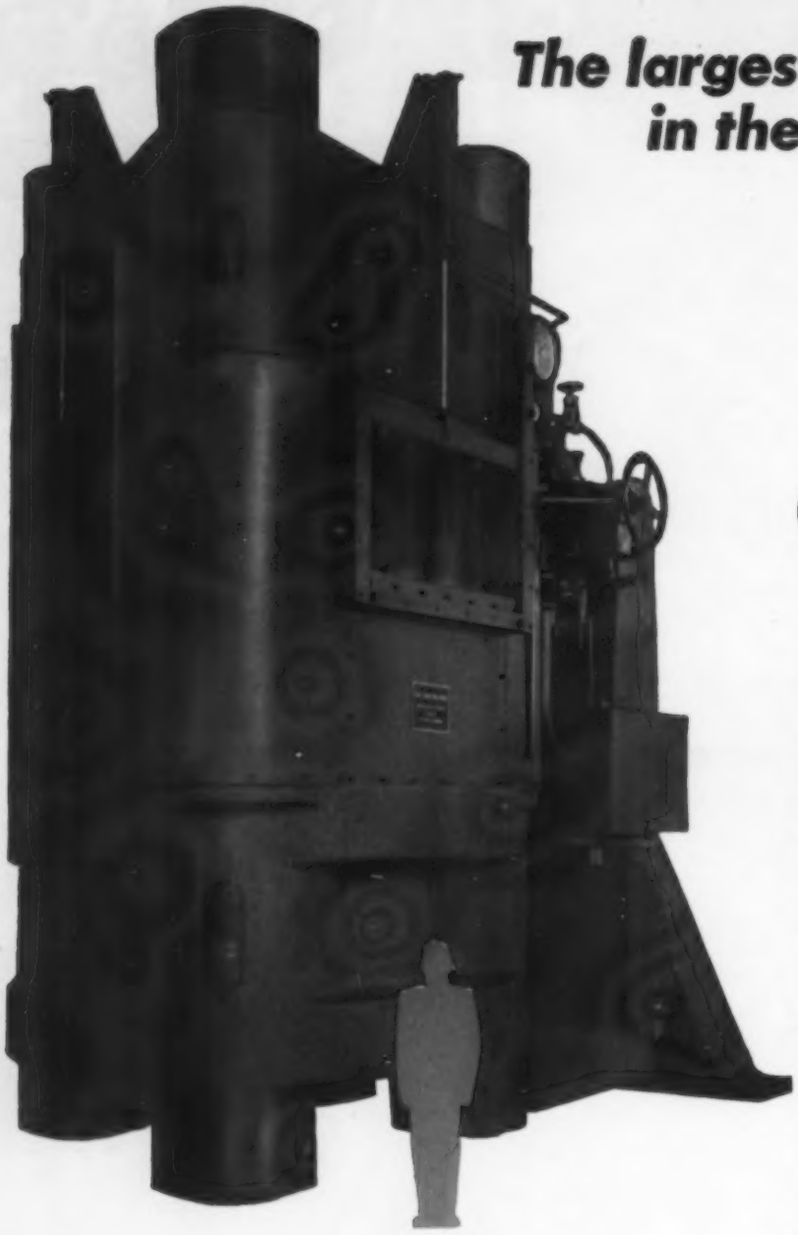
Cellulose acetate butyrate is used to mold this fountain pen desk set for home or office. The material was selected because it has a naturally lustrous surface which can easily be kept free of dust, fingerprints, or ink stains. The molded-in color cannot chip or peel. The set is available with any of five types of points. The bases and pens are injection molded of ebony, maroon, ivory, green, walnut, or jade Tenite by Bert M. Morris Co., 8651 W. Third St., Los Angeles, Calif.

A special flame-resistant formulation of cellulose acetate was chosen for molding the housing of the new Sunbeam Shavemaster. The rugged plastic housing virtually eliminates breakage due to dropping. The combination of colorful plastic and gleaming chrome gives the razor eye appeal and therefore sales appeal. A brush-type self-starting AC-DC motor drives the hollow ground oscillating cutter. The housings are molded by the Sunbeam Corp., Chicago, Ill., manufacturer of the razor. The material is Lumarith

A plastic toilet seat adaptable to home or commercial use is this one molded of urea. The finish will not chip or crack, the seat itself will not warp, and it will withstand common cleansing detergents and weak acids. The seat and lid are molded of Plaskon and are designed for strength and resistance to splitting. The unit is available in standard colors. It is molded by Lanfare Molded Products, Toledo, Ohio

Advertised as the world's smallest hearing aid, this Beltone Mono-Pac has a fawn-colored Melmac case. The case houses batteries and a printed silver circuit in which the equivalent of 45 electronic parts are heat-fused into a tiny ceramic chassis. The hearing aid can be worn in the pocket or under clothing. The melamine case is molded by Plastic Molders, Inc., 3670 N. Milwaukee Ave., Chicago, Ill., for Beltone Hearing Aid Co., 1450 West 19th St., Chicago

The largest hobbing press in the plastics industry



Hobbed Cavities *by* Midland . . .

An important addition to Midland's expanding facilities is this 8000 ton hobbing press, the largest of its kind in the plastics industry.

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With this press, Midland is prepared to supply plastic molders with hobbed cavities for large plastic parts including radio cabinets, large container escutcheons and instrument housings. Multiple cavities can be hobbed . . ."like peas in a pod". . . quickly, with complete uniformity and accuracy. Multiple cavities will speed up your production with a minimum of expense.

Midland experience and facilities, in addition to skilled craftsmen, are ready to serve you . . . to produce the finest and deliver on time when you specify "Hobbed Cavities by Midland."

Write for your copy of "How to Heat Treat Hobbed Cavities," a practical heat treating treatise to help you get the best performance from Hobbed Cavities by Midland.

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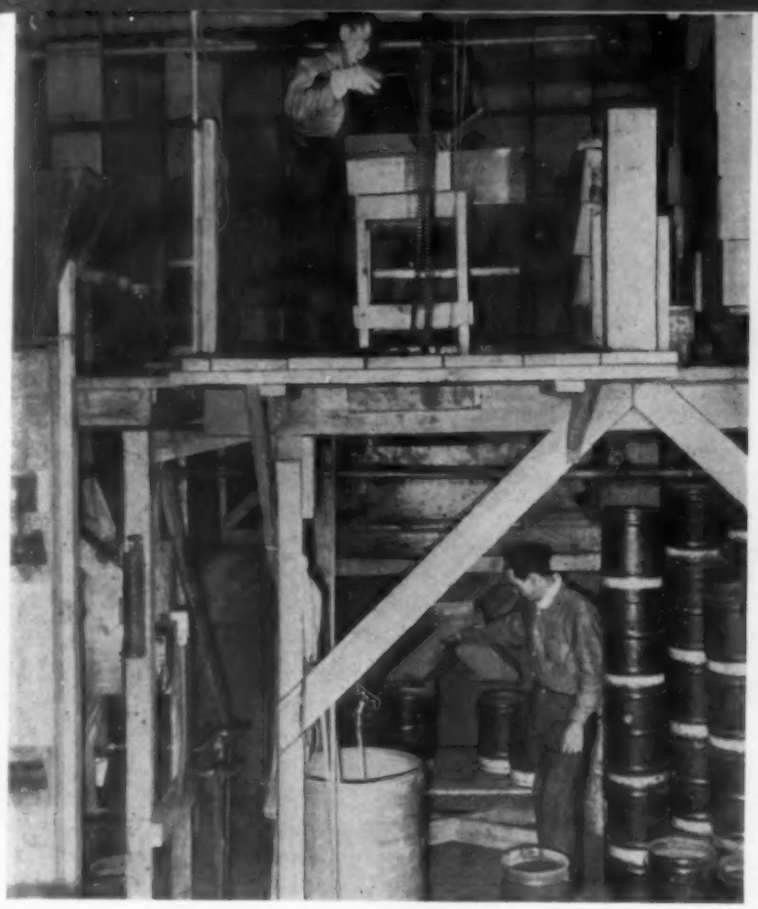
Makers of Plastic Molds ★ Die Cast Molds ★ Engraved Dies ★ Steel Stampings ★ Hobbings ★ Pantograph Engraving

F. B. STANLEY, Engineering Editor

PLASTICS ENGINEERING*



Blended vinyl material, after cooling, is broken into pieces for convenient handling, then fed into grinder. Ground material drops through chute. It then goes through magnetic separators for removing any metal which may be present. Processed material is taken to press floor and placed in preheater units

Vinyl Records

They can be molded in short cycles, their reproduction quality is high, and they wear longer than shellac records

PHONOGRAPH records have come a long way since Emil Berliner first developed shellac molding compounds for this purpose in 1895. Shellac materials are still used in considerable quantities for record manufacture because they are inexpensive, easily molded, and permit high fidelity reproduction of the sound track. But record making firms are constantly experimenting with other materials to obtain better reproducing quality and durability.

Plastic materials have received careful scrutiny by record manufacturers. Unfilled records have been successfully made, on either an experimental or production basis, of cellulose nitrate, cellulose acetate, ethyl cellulose, methyl methacrylate, polystyrene, and the vinyls.

Tests have shown that polystyrene lacks sufficient abrasion resistance for a satisfactory record. Ethyl cellulose, too difficult to mold by itself with delicate copper "stampers" or molds, works quite successfully when used in combination with other materials. Cellulose nitrate produces a good record, but has never been an important factor in this field because of its flammability.

As mentioned in an earlier article,[1] vinyl resins have enjoyed increasing acceptance in the record manufacturing field. In selecting Vinylite resin for its new Victor Red Seal De Luxe record, first placed on the market in October 1945, the RCA Victor Div., Radio Corporation of America, was guided by three principal factors: the reproduction quality of finished records made from this material, its ability to be molded satisfactorily with a fairly short cycle on semi-automatic equipment, and its acceptable price range, which made it possible to sell the finished 12-in. records for $2.

RCA Victor technicians point out that a high modulus of elasticity is one of their major requirements in a material to be used for molding an unfilled type of record. The use of highly plasticized materials is not considered advisable; any tendency

*Reg. U. S. Patent Office.

[1] "Molded vinyl phonograph records," MODERN PLASTICS, *24*, 107 (July 1947).

Preheater automatically measures out material. Each cup contains right amount for one 12-inch record and flash

toward a "rubbery" quality in the plastic leads to rapid wear in the record. Nor does a record molded of such highly plasticized material reproduce high frequencies well.

Preparing the material

In one of RCA's principal record production plants, at Indianapolis, production of the vinyl records begins with actual compounding of the molding material. The basic copolymer, Vinylite VYHH resin, contains 87% vinyl chloride and 13% vinyl acetate. It is combined with a metallic stearate, which functions primarily as a stabilizer; wax; and a red dye of an oil-soluble type which is added as a powder. The wax acts as a lubricant and parting agent for the otherwise hard material.

The red dye used for this record produces a record which is translucent and yet not so transparent that the record grooves from the opposite side show through to produce an undesirable pattern. A completely transparent record, easily attainable from the production standpoint, exhibits this pattern, and it is difficult for the person playing the record to see the edge clearly enough to place the pickup in proper position.

The components are blended in a ribbon blender in batches of around 3000 lb., the complete blending process requiring about 20 minutes. The usual practice is to introduce half the vinyl material into the blender with half the other components, then to add the balance of the vinyl and the remainder of the other ingredients.

After blending, the material is charged in 300-lb. batches into a Banbury mixer and milled for an overall cycle of approximately 8 minutes. Fusing during this period, the material leaves the Banbury as a hot wad at around 270 to 280° F. There follow four passes through a two-roll even speed Farrel-Birmingham roll, after which the material is sheeted out on a cooling belt 42 in. wide, in the form of a continuous ribbon ¼ in. thick. It requires about 2 min. for the material to travel the length of the 55-ft. belt, during which period it is subjected to streams of cooling air at an average temperature of 55 to 60° F. During its progress along the belt, the web of material is scored by rollers to facilitate breaking up of the plastic into slabs preparatory to further operations.

Leaving the cooling belt at a temperature of 100 to 110° F., the material is manually broken into pieces of convenient size for handling. In this form, it is placed on glass top inspection tables illuminated from beneath by 1000-watt bulbs and examined for dirt, smears of oil, or other foreign matter. Any such extraneous matter is removed by the inspectors and the slabs pass on to the next operation in the preparation of the finished molding material.

The next step is a grinding operation. The broken up pieces of vinyl material are placed in a Ball and Jewel cutter which granulates it at the rate of 1500 lb. per hr. producing molding particles having a size up to ⅜ inch. Then the granules pass through two magnetic separating processes to remove any tramp metal present. In the first of these operations, the material goes over an enclosed pulley having a group of electromagnets on its inner surface. In the succeeding operation, the material traverses a zig-zag chute having five permanent Alnico magnets located at different points to remove any remaining tramp metal. Material being processed is fed through the chute at a constant rate by a vibratory feeder.

Molding the records

Following the two magnetic separating operations, the vinyl material is ready for molding and is stored in 50-lb. metal drums until used. It may be stored for an indefinite period if necessary, although material compounding and molding in actual practice are so scheduled that there is little opportunity for material to accumulate long. There is a slight moisture pickup during storage, but this creates no problem because the material is dried just before being placed in the press. This eliminates any moisture which may have been picked up by the labels.

The Red Seal De Luxe records are molded by a battery of tilting head type hydraulic presses equipped with a compressed air type cycle controller. This arrangement controls the steam for heating the platens, water for cooling, hydraulic pressure, and the air cylinders which open and close the swing leaf. The 12-in. record presses have a 12-in. piston and are rated at 85 tons. They use water from a central supply system at 1800-lb. pressure. Cylinder travel during the molding operation is only

from ¾ to 1 inch. Presses are paired off for operation by one operator, with one preheater serving each pair.

The complete molding cycle per record requires about 1 minute. Molds are first heated with 150-lb. steam to a temperature of approximately 300° F. To terminate the cycle, they are then cooled with water at 140 lb. pressure and 65° F. to a temperature of between 100 and 105° F., after which the press opens automatically.

The infra-red dryers and preheaters hold approximately 150 lb. of molding material, which in normal production will last about one-third of an 8-hr. shift. They are fitted with vibratory conveyors which shake out the required amount of molding material into a small cup, operation being properly synchronized with that of the presses. The paper labels which go on each side of the records are also thoroughly dried in another section of the preheater before being placed in the press.

As soon as a press opens, the operator positions the labels on each half of the mold, or "stamper," as it is called. Then she empties the cup of preheated material into the lower half of the mold and trips two levers which close the press and initiate the molding cycle. Use of two control levers, requiring her to use both hands to close the press, is for reasons of safety.

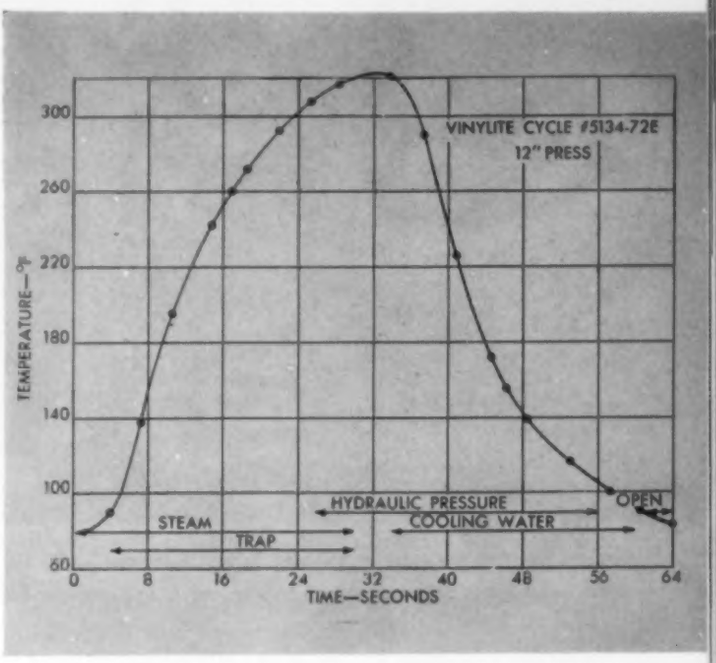
While one press is going through the process of molding and cooling, the operator removes the finished record from the companion press, hand trims the flash with a knife, places the record on a spindle which holds 50 records, and loads the press for its next cycle. Rapid action is required on the part of the operator because on completion of one cycle, the mold immediately begins heating up for the next.

The stampers, produced in the RCA plant from the original recordings, are of 0.020-in. electroformed copper with approximately 0.001 in. of nickel and a final chrome plating 0.0002 in. in thickness. They are secured to the press platens by a hold-down ring around the outer edge and the center plate at the inner edge. This arrangement permits a quick changeover when switching to another record or when replacing worn stampers. Molds are of the flash type, facilitating the changing of stampers, and must be loaded with sufficient material to produce 15 to 20% flash in order to insure perfect filling out of the outer grooves of the record. Flash is reground and combined with new material.

Finishing and inspection

As they are trimmed and placed on the spindle, records are slip-sheeted with discs of soft blotter paper to prevent random grit from being trapped between records and causing scratches. When a spindle of 50 records is completed, a punched tabulator card for that particular "order" is placed on top of the stack and the entire spindle is passed along for finishing and inspection by the operators.

The 50 records are given their final edge finishing by rotating the spindle on a turntable and holding a heavy file against the edge of the stack. This is fol-



Records are molded in 1-min. cycle. Molds are heated with steam, then cooled with water. Press opens automatically

Operator pours vinyl granules into press. After closing press, she will trim flash from record molded previously

Records go from the press to finishing lathes in spindles of 50 records. Rough edges are removed with finishing paper or sandpaper belt

lowed by final rotation with a waxed cloth moved up and down against the stack. The finished record must have an outside diameter of 11⅞ in., ±1/32 in., so that the record can be used satisfactorily with automatic record changers.

After the finishing operation, each record is inspected visually for possible molding flaws or other imperfections. As a further check on quality, a fixed percentage of the records are played in a special testing booth for possible imperfections not detectable on visual examination. If a flaw is discovered in this test, all records on the same spindle are held up for further examination and possible rejection. The tabulator punch-card system used in controlling the molding of the records is so designed that inspectors have but to check the control card at the proper point and pass it back to the press operator to call her attention to molding imperfections or other flaws which must be corrected. The cards are passed out to the operators in batches, along with the required number of correct labels. As indicated earlier, each card constitutes an order for 50 records.

After final inspection, the vinyl records are placed in boxes on conveyor belts which transport them to the packaging department. Here they are placed in individual envelopes or assembled into albums, wrapped, and boxed.

Care of records

What happens to the record after it leaves the plant can affect the quality of the tone produced by the record. Therefore records must be handled properly by the user if they are to provide maximum reproduction performance and wear. Among the points which should be considered in this connection are the type of needle used, the weight of the pickup or tone arm, and the problem of keeping the records free of dust, grit, and other foreign matter.

The Vinylite record has an extremely low noise level, because in any record made from an unfilled material, noise level is mainly a function of the stamper from which it was made. There are no particles in the record itself of sufficient size to produce a sound audible to the human ear. Thus the only factor over which the user has control is that of keeping the record free of dust particles and other material which will increase noise level and result in more rapid wear.

Dust and collected grit are a problem with these records because they have a tendency to build up a static electric charge as they come from the press. The charge is slowly and naturally dissipated, but is immediately built up again when the record is rubbed off with a dry cloth, or through friction in contact with the turntable. To obviate building up of this charge, the record should be wiped off occasionally with a soft cloth which has previously been dampened. Static discharge coatings have been tried to overcome this difficulty, but they maintain a slight film of absorbed moisture which holds dust and thus defeat their own purpose.

The conventional type of filled record is not subject to this problem, because it is sufficiently conductive to pass off any static charge much more rapidly instead of retaining it.

Wear resistance of vinyl records

In the early days of recording, the stylus or needle was likely to be almost any odd shaped piece of wire. Thus, one function of the mineral filler used in the record was to grind the stylus down to proper shape so that it would seat properly in the grooves and give maximum reproduction performance. Modern styli, on the other hand, are usually ground to approximately correct shape, though there are still some poorly shaped needles on the market.

This mixture of available needle types poses a problem in connection with unfilled records. If they are played with a poorly shaped stylus having sharp irregularities, the unfilled type of records will wear more rapidly than the conventional filled variety. However, when played with a properly shaped stylus of steel, sapphire, osmium, diamond, or other suitable material, the vinyl type of record will provide from two to four times as many plays as the shellac variety.

The unfilled type of record will also provide more plays with the modern, light-weight style of tone arm than with the older, heavy type of pickup. However, assuming the use of the proper type of needle, the vinyl record will give proportionately longer wear than the shellac type, regardless of the weight of the pickup used.

Pulp Molding Tools

by JOHN J. JAEGER*

FORMING and drying pulp products is essentially a molding process despite the fact that the method of approach in designing the tools borrows generously from the techniques of the die designers of the metal forming industries. The nomenclature of the mold set itself—the cavity and the plunger—while aptly applied, is also the nomenclature of the die sets used in metal drawing. The process of pulp molding is universally known in the industry as "die-drying", and is defined as the pressing to shape and drying of a wet pulp preform within the confines of a metal die.

Pulp molding tools perform three functions: preforming of the article to be molded; transferring of the wet preform to the mold; and molding to shape and drying the article. The first operation is known as felting; the second as transferring; and the third as die-drying. Although it would seem logical to discuss the design of these tools according to their sequence of operation, the die-drying tools will be described first because it is here that the final form of the article is determined; it necessarily follows that the design of the other tools must be governed by the demands of the die-drying tools.

After the shape and dimensions of the molded pulp article have been decided upon, the designer usually starts with the half of the mold which is to impart the smoothest finish to the article, and, therefore, is the side whose dimensions must be most accurate. (It will be shown later why there is a difference in the finish of the two sides of the molded article). This half of the mold may be either the cavity or the plunger, depending upon whether the finished side is concave or convex by nature. The requirements to be considered in the design of this half of the mold, in the sequence of their importance, are: the exact shape of the finished piece, the strength of the mold, and the method of heating.

The shape of the article is, of course, influenced by the known limitations of the mold with respect to undercuts, angles of draft, and the relationship between the depth, width, and section thickness of the finished piece. Ordinarily it is considered that articles demanding undercuts are not good applications for molded pulp unless the undercut can be machined into the finished piece. However, it is feasible, where the situation demands, to design and build molds with auxiliary plungers to accomplish certain types of undercutting. Since this type of mold is very special and quite out of line with standard practice, it will not be discussed here.

Draft angles important

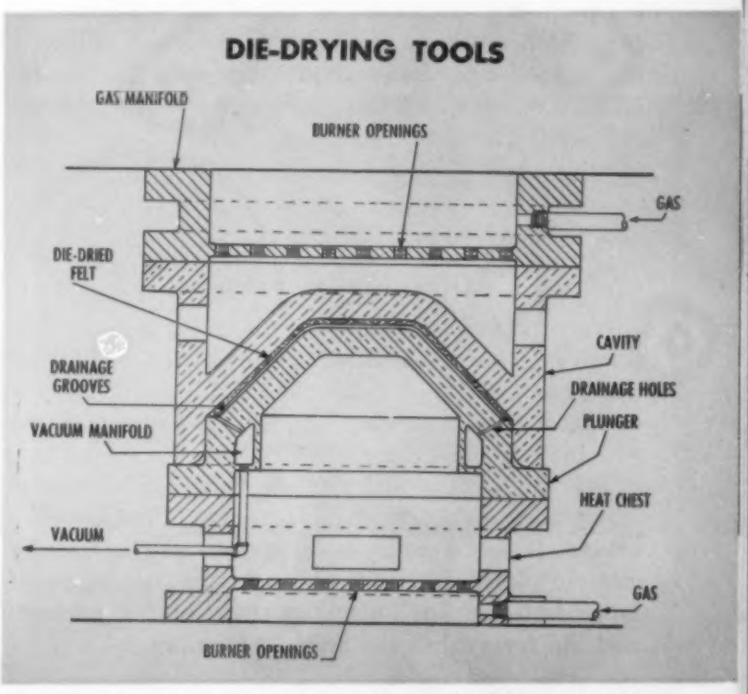
The angle of draft usually ends up as a compromise between the customer and the designer, except in cases where the sides of the article have necessarily generous slopes or are so short that the matter of draft is of little consequence. On items where the sides are over ½ in. long, it is desirable to have a draft of from 1 to 5°, depending on the length of the side. A much larger draft angle is often necessary where the section thickness is great in relation to the height and width of the article. The density of the section enters into this consideration; to build up a very dense section, it is necessary to add to the thickness of the preform, and if the thickness of the preform is such that it will not enter into the cavity, or the plunger will not enter into it unless the relationship of the draft angle to the depth of the article is great, then suitable draft angles must be provided or a proper entry will not be effected and the pulp preform will be torn instead of being progressively compressed into shape.

Pressure determines wall thickness

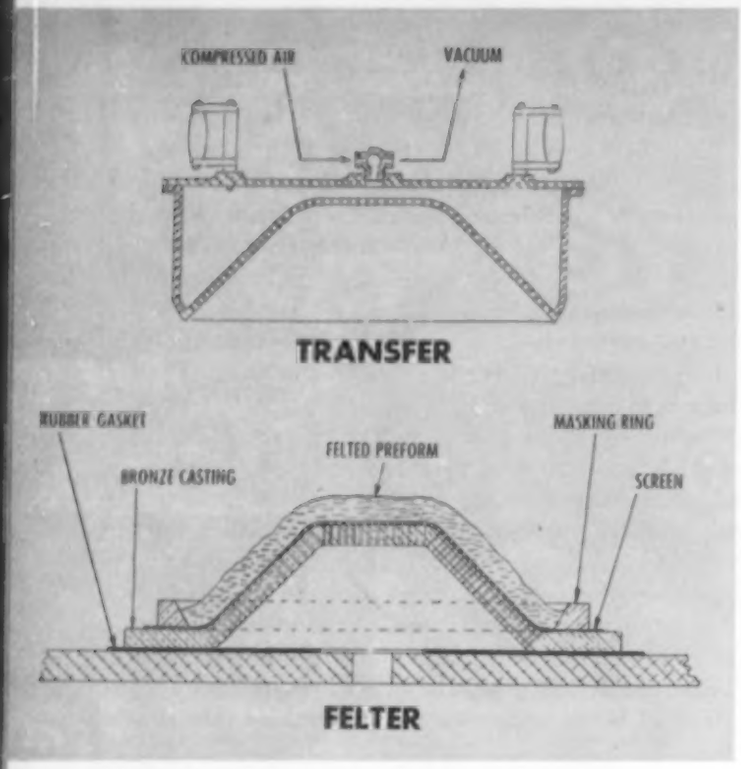
The strength of the mold is determined, of course, by the pressures it must withstand. Wall thicknesses and supports are designed accordingly. Ordinarily, the designer does not work under any serious limitations in this respect and can allow for the large factors of safety which are desirable in this type of molding due to great local stresses sometimes encountered in compressing a material of this nature.

Since the process of die-drying is one which not

1 — A typical mold which removes moisture from the wet pulp preform, presses it to correct shape, and cures the resin



*Chief engineer, Engineering Associates, Inc., St. Charles, Ill.



2 — Diagram of the felter and shell-type aluminum transfer. The latter is used to transport the shaped felt to the mold

only molds a preform to shape but also dries it, heat must be supplied to facilitate the drying. This is done in one of three ways. The most commonly used method employs gas, premixed with air, which is introduced into a chamber called the heat chest. Here burner tips are strategically located to give uniform heat distribution to the mold. The upper heat chest in the case shown in Fig. 1 is a casting which conforms to the shape of the back of the mold and which is divided into an upper and lower chamber by means of an integrally cast baffle. The chamber which opens to the back of the mold contains the burner tips, screwed into tapped holes in the baffle, through which the gas from the other chamber is forced. The chamber where the gas is burned is provided with cored openings or flues which will permit the products of combustion to pass to the atmosphere.

Other heating methods

A second method of heating the molds is to provide a steam jacket as an integral part of the mold. The third method employs electrical heating units, either attached to the mold itself or cast into platens against which the mold bears.

The half of the mold already described is the one which imparts the finish to the smoother side of the article. It has a solid molding face and is usually chrome plated. This not only adds to the degree of finish but also facilitates the entry of the preform and the removal of the finished molding.

The other half of the die-drying mold performs the double function of molding the piece and also removing the water which is squeezed out of the preform. It too can be either the plunger or the cavity although the problems of design are somewhat simplified in most cases if this half can be made the plunger. Its shape must conform to the side of the article opposite to that which was mentioned above as the smooth side. The explanation for the relative roughness of this side is found in the following description of the method of water removal.

Vacuum applied for water removal

When the wet preform is squeezed between the two halves of the mold, the pulp fibers are compressed and form a seal which prevents the water and the steam which the hot mold has formed from escaping in large enough quantity through the parting of the molds as they are being closed. This method of water removal would be highly objectionable under any circumstances. Therefore, provision must be made to draw the water from the mold in a faster and more efficient manner. There are two ways in which this can be accomplished and their use depends upon whether or not this half of the mold is to be heated. If the molded article has a very thin section, it may be necessary to heat only the smooth half of the mold and depend upon its heat to effect the drying. When this is the case, holes are drilled through the drainage half of the mold with about a No. 41 drill. The distance between the holes, which cover the entire surface of the mold, is approximately that of the diameter of the drill used. The surface of the mold is then covered with a formed copper screen of approximately 60 mesh or with a formed perforated brass sheet. Vacuum is applied on the under side of the mold and the water and steam are drawn off.

Manifolds for water

Since it is usually more economical from the time-cycle point of view to heat both halves of the mold, it is necessary to draw off the water through channels which will not allow it to come in contact with the heating apparatus. Obviously, the only means of achieving this is through the use of manifolds. The manifolds are either cored ducts around the insides of the mold (Fig. 1) or channels cast into the mating flange of the heat chest. The manifolds are connected to the vacuum pump through the flues of the heat chest, in the case of a cored manifold, or directly to the outside in the case of heat chest channels.

Since the heated mold cannot be drilled straight through to the heat chamber, the water is led to the manifolds by means of a series of grooves which traverse the face of the mold and terminate at holes drilled through the manifold. The grooves, made with slotting saws after the mold has been completely machined, are approximately 5/64 in. wide and deep. Unless the finish on this side of the article

cumstance, the grooves are left uncovered. The bridging action of the fibers prevent the filling of the grooves and the water is able to be drawn off. However, where the finish is to be as smooth as possible, the mold surface and the grooves are covered with a formed perforated brass sheet. In the case of the uncovered grooves, the finished article shows a series of ridges corresponding to the grooves; where the perforated sheet is used, pimples appear corresponding to the perforations.

The construction of the die-drying molds as outlined above applies generally to the three types of molds commonly used; the flash type, the semi-positive type, and the fully positive type. These molds are, in practically every instance, castings which embody the various features necessary in the performance of the job. The castings are bronze, which has the required strength, is not affected by the water and steam, and has good heat conductivity.

Requirements of preform

With the design of the die-drying molds completed, the requirements of the preform become more apparent and the shape of the felter can be determined. This shape corresponds either to that of the plunger or the cavity and usually to the one which is to be equipped with drainage facilities.

The felter (Fig. 2) is a relatively thin sectioned shell type bronze casting. The entire surface of the felter corresponding to the surface of the finished molded article is drilled and screened, the drilled holes being the same in size and spacing as mentioned above. When the felter (Fig. 3) is lowered into the felting tank containing the pulp and water slurry, and vacuum is applied to the underside of the felter, the water is drawn through the screen and the holes. Fibers carried in by the water are left in a more or less uniform layer on the screen. The thickness of this deposit, called the felt, is regulated by the pulp consistency and the length of water. When the felter emerges from the water (Fig. 4), the vacuum is continued for a short time to draw off as much water as possible. The vacuum is then shut off and the felt is ready for transfer to the mold.

Transferring the felt

The tool used in removing the felt from the felter and transporting it to the mold is called the transfer. It is a shell type aluminum casting (Fig. 2) which nearly corresponds in shape to the outside surface of the felt. Ordinarily, removal of the felt can be accomplished by merely pressing the transfer down over the felt on the felter and applying compressed air to the under side of the felter. A partial vacuum is formed between the transfer and the felt and the pressure on the felter side causes the felt to be released from the felter so that it can be carried away in the transfer. When the transfer is placed on the mold half containing the drainage grooves or holes, and vacuum is applied, the felt is pulled away from the surface of the transfer and sucked down onto the mold.

In cases where the felt is either too thin to support a partial vacuum between it and the transfer or is too heavy to be held in place by a slight vacuum, a positive vacuum must be supplied to the transfer. To do this, the transfer must be constructed so as to have a vacuum chamber behind the transferring surface with holes drilled through to allow the vacuum to act on the felt. The vacuum is supplied to the transfer through a flexible hose fitted with a hand operated control value. In this case, compressed air must be supplied to the transfer to aid in the release of the felt.

The transfer is the only tool which is actually handled by the operator in this molding process. For this reason, it is made of aluminum and its section is as thin as possible to decrease the weight which the operator must handle.

3 and 4 — The felter (left) is submerged in a tank containing the pulp and water slurry and vacuum is applied to the underside of the felter so that felt adheres. The vacuum is continued for a time after the felter emerges (right)

PHOTOS COURTESY HAWLEY PRODUCTS CO., ST. CHARLES, ILL.

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The TRU-VUE Stereoscope and Library Case were designed by The Mast Development Co., Davenport, Iowa, and are products of TRU-VUE, Rock Island, Ill. The viewer is molded by Barber-Colman, Rockford, Ill., and the case by General Electric, Decatur, Ill.

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Plaskon Molded Color is non-electrostatic. It is resistant to commercial organic solvents and weak acids, and it will not support combustion. Thermosetting Plaskon urea- and melamine-formaldehyde molding compounds have a wide range of advantages, that induce greater efficiency in manufacturing and merchandising methods. Our experienced field men are available to help you adapt thermosetting Plaskon* Molding Compounds to your particular needs. *Reg. U. S. Pat. Off.

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Plant Fire Protection

by S. G. FRECK*

A specially ground cutting off tool enables operator to cut fluted rod to length. It also domes the end of the handle

A shaped groove is cut into one end of a screw handle blank after which a stationary drill, mounted in the tail stock of the screw machine, drills a hole in the blank. A screw driver tang is later press fitted into the hole

FOR more than 10 years a compact little factory, Industrial Plastics Corp., Caldwell, N. J., has been turning out plastic handles for some of the country's biggest manufacturers and distributors of carpenters' tools. Starting with extruded cellulose nitrate rod in various sizes, all plastic forming, cutting, drilling, dipping and bit assembly operations are performed here to produce more than 300,000 screwdrivers every month.

Although forming, cutting, and drilling of cellulose nitrate requires application of a coolant or lubricant in many cases, Industrial does not find it necessary to use either. Loading of drill bits with chips presents no problem either, as the drilling speed employed produces a curling chip which works its way out of the drill flutes.

All machining takes place on belt driven lathes with manual control carriages and tool holders, in one room, where machine layout allows for convenient handling of rod stock.

After machining operations are completed, the tool handles are placed in a screened tumbling barrel where tiny chips of waste material are removed. The handles are tumbled on themselves and require no additional tumbling agent.

Handles are then given a preliminary dipping in butyl acetate and dried on racks in special wooden trays. Some handles get additional dipping in black

(*Please turn to page* 138)

*Manager, Industrial Div., Walter Kidde & Co., Inc., Bloomfield, N. J.

After the tool handles have been machined to proper shape, they are placed in a screened tumbling barrel for removal of chips of waste material. No tumbling agent is required

PLEX UPHOLSTERY, BY BARRETT TEXTILE CORP., ON UNI-DAPT FURNITURE, BY LEWITTES & SONS

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s modern and adaptable as the new snap-together furniture shown ove is the Perbunan-polyvinyl chloride upholstery fabric . . . used doors or out—wherever colorful long-wearing materials are wanted. erbunan when used as a blending material with polyvinyl chloride s shown itself to be superior to many liquid plasticizers in many portant ways. It's non-volatile . . . eliminates stiffening from plasticizer loss . . . is non-extractable and non-migratory under normal exposure conditions . . . reduces the low-temperature brittle point of vinyl compounds . . . has low moisture-vapor penetration . . . low heat conductivity . . . and has excellent color stability! For further information on Perbunan-polyvinyl chloride blends please write to Enjay Company, Inc., 15 West 51st Street, New York 19, N. Y.

for colorful coated fabrics that resist practically everything...

use PERBUNAN
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with vinyl resins!

This advertisement, which appears currently in TIME, DEPARTMENT STORE ECONOMIST, and CHAIN STORE AGE, continues the Cyanamid series to promote the proper application of the right plastics.

AND.....

He lost the load, but not the dishes!

ONE OF THESE IS THE KIND THAT CAN TAKE IT

YES, the poor fellow lost his trayful. But not a dish was broken.

You see, even a thoroughgoing beating may not break or crack tableware molded of MELMAC*. That's one of the big reasons why so many restaurants and housewives are buying it. And, in addition to break resistance, tableware molded of MELMAC offers many other time-saving, money-saving and appearance-saving properties. For example:

Only ⅓ as heavy as standard earthenware service, it nevertheless has the feel and lustre of high-grade dinnerware.

Its lovely pastel or richly brilliant colors cannot chip, peel or wear off because they go all the way through from surface to surface.

Made of a *thermosetting* plastic, it will not soften or deform in hot water . . . wash it just as you would china . . . and it is not hurt by strong soaps or typical kitchen detergents.

It keeps food hot or cold as desired, since it is a poor conductor of heat.

It is quiet in use . . . eliminates kitchen and tableside rackety-clatter created by china and earthenware.

* * * *

More and more tableware and other products identified as "Molded of MELMAC" are reaching the markets. Look for the identification via informative labels and leaflets.

** MELMAC is American Cyanamid Co.'s Reg. U. S. trade-mark for condensation products of aldehydes and amines.*

BE SURE *YOU* KNOW THE DIFFERENCE

Two dishes may look alike. The difference is that one is made of the right plastic, properly designed and applied. When buying, selling or making plastic products or parts, request information that will assure you they are soundly designed in the plastic best suited for the job.

QUESTIONS PLEASE! Our technical staff will be glad to help you solve problems in plastic application and design. And if our materials do not fill the bill exactly, we will cheerfully direct you to the right sources. American Cyanamid Company, Plastics Division, 32 Rockefeller Plaza, New York 20, N. Y.

Cyanamid Plastics

PLASTICS DEPARTMENT, AMERICAN CYANAMID COMPANY

BEETLE* plastics—urea-formaldehyde thermosetting molding compounds. MELMAC* plastics—melamine-formaldehyde thermosetting molding compounds, industrial and laminating resins. URAC* resins—urea-formaldehyde thermosetting industrial resins and adhesives. MELURAC* resins—melamine-urea-formaldehyde thermosetting adhesive and laminating resins. LAMINAC* resins—thermosetting polyester resins.
*Reg. U. S. Pat. Off.

...Again Speaking of the Right Plastic Properly Applied,

Here's another outstanding example showing Decorative Laminates made with Cyanamid's MELMAC* Resin

The *Olympian Hiawatha* is described by the Chicago, Milwaukee and St. Paul Railroad as the most beautiful, most comfortable and most practical train the line ever built. In designing and constructing this new train, the railroad took fullest possible advantage of the special properties of laminates made with MELMAC Resin as produced by Formica Insulation Company . . . using them throughout the train in sleepers, diners, club cars, lounges and observation car.

Hundreds of products were carefully investigated before final selections were made . . . here are some basic reasons why Formica's MELMAC resin laminates were chosen:

. . . range of colors virtually unlimited.

. . . surfaces are cigarette-proof and resistant to alcohol and common solvents.

. . . ease and economy of maintenance. (Just wipe off to maintain gloss.)

. . . great resistance to marring and scratching.

. . . decorative features include inlaid designs and patterns as well as full scope of color.

. . . smooth, lustrous surface enhances high-quality appearance.

MELMAC laminating resins offer unlimited possibilities for sound design, colorful beauty and long-life performance. For technical data on whatever application you have in mind, write to Plastics Department, American Cyanamid Company, 32 Rockefeller Plaza, New York 20, N. Y.

Because Formica, a MELMAC resin laminate, contributes to long life in first-class condition and easy car maintenance, it was used throughout the entire crack train recently completed by the Chicago, Milwaukee and St. Paul Railroad . . . for wainscoting, bottom surfaces of upper berths, seat backs, window sills, wall areas, bar tops, table tops, etc.

*Reg. U. S. Pat. Off.

Left — Nine thousand handles per day are dipped in a tank containing butyl acetate. Both tank and drying room are protected by a carbon dioxide flooding system. One of five nozzles which discharge the gas if fire occurs can be seen here

Below — Nerve center of flooding system is a fire detector which is located on ceiling of the dipping room

If fire breaks out in plant, 50-lb. cylinders, above, supply liquid carbon dioxide to strategically placed nozzles

or red butyl acetate, and are embossed, depending on customer specifications.

Next, the handles go to the assembly room where metal bits are fitted in the handles' drilled holes. In assembly of most screwdriver handles and bits, a single hammer blow achieves a permanent fit. Forced on by impact in a cushioned bit holder, at the rate of 800 to 1000 per hr., the freshly-dipped handles later shrink slightly to make the fit even tighter.

Automatic carbon dioxide system

Working with highly flammable material in daily processing of 12,000 plastic handles, every precaution has been taken against the possibility of fire by installing a fully automatic carbon dioxide flooding system, built in by Walter Kidde & Co., Inc., fire protection engineers. The greatest fire hazard exists in the dipping and drying room, where more than 500 handles at a time are dipped.

Industrial Plastics' automatic fire protection consists of two 50-lb. cylinders of liquid carbon dioxide stored under 850 p.s.i. pressure, located outside the dipping room, and connected by a simple piping network to five discharge nozzles, strategically placed around the walls. The automatic system is actuated by a rate-of-temperature-rise detector in the center of the ceiling.

Operating simultaneously with gas discharge is a pressure operated trip which automatically closes the door, two windows, and the dip tank cover. In the event of sudden fire, clouds of carbon dioxide "snow" discharged from the nozzles permeate every nook and corner of the room, reduce the air's normal oxygen content from 20% to around 15%, a point where combustion cannot be supported. In an instant, fire starting in the dip tank would be out, with no substantial damage to the immersed or drying plastic tool handles.

While the Kidde fire protection system is designed for entirely automatic operation, it can be started manually by a pull chain at the cylinder source.

In addition to this 24-hr. automatic fire protection, Industrial Plastics keeps several portable carbon dioxide extinguishers, equipped with trigger release grips and wide dispersal nozzles, easily accessible for smothering incipient fire in the machining room and other production areas.

TECHNICAL SECTION

Long Time Load-Deformation Effects in

Viscoelastic Materials

by C. HOWARD ADAMS* AND M. C. THRODAHL†

The long time load deformation effects in viscoelastic materials, including stress relaxation, creep, permanent set, cold flow, and recovery, are of great interest to those concerned with the manufacture and use of these materials. Some of the fundamental concepts involved and the theoretical and practical significance of the data obtained from tests of this nature are discussed.

Rubber has been the object of stress relaxation and creep studies longer than any other polymer system. During the past 15 years much theoretical work has been carried out on the molecular structure of rubber and synthetic elastomers based on long time data. The meager work done on long time testing of the rigid polymers until shortly before World War II was greatly accelerated during the period of conflict. Data that resulted are of practical importance but generally speaking, insufficient for theoretical analysis. A survey of some of the data available on viscoelastic properties of polymeric systems is given.

MUCH can be gained from a study of the long time behavior of rigid and non-rigid (elastomeric) polymers subject to load or deformation. Such studies are of interest to the physicist, the chemist, and the design engineer. The physicist studies the fundamental properties of the high polymer systems in an attempt to correlate observed behavior with theoretical considerations. To date, this work has been concentrated in the field of non-rigid polymers, rubber in particular. The chemist studies the change in long term properties brought about by changes in formulation while the design engineer interprets the data available in terms of the structural suitability of the material.

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Creep tests for both rigid and non-rigid polymers are, for the most part, conducted under constant tensile load conditions (1, 2, 3, 4, 13, 14, 20, 23, 25).[1] However, creep in torsion (5) has been used for the evaluation of elastomers. Creep in compression or "cold flow" (6, 7) is another method that finds rather wide use. Creep tests are run for the purpose of measuring deformation under constant load conditions as a function of time at some fixed carefully controlled condition of temperature and humidity. Stress relaxation studies are, in general, carried out by elongating a specimen some fixed amount and measuring the stress decay with time.

From creep data the total deformation, creep rate, permanent set upon release of stress, and recovery can be determined. Stress relaxation data give the total stress decay as a function of time from which can be determined the rate of stress decay.

At the present time insufficient data are available on the creep characteristics of rigid high polymer systems over a range of temperatures to test the validity of the theoretical relationships developed by Eyring (8), Kauzmann (9), Kistler (10), and others. The creep tests that have been carried out on rigid polymers thus far provide, for the most part, useful engineering or application data.

Subjection of elastomers to mechanical stresses results in unusually complicated behavior. Recent theoretical researches (11-16) have shown that this behavior cannot be described satisfactorily by either of the classical theories of elasticity or viscosity. The general molecular theories which describe the behavior of elastomers (12-15) have experimental verification manifested by three regions of temperature-stress relationship: a) a low temperature region in which stiffening is observed due to the stability of secondary bonds between network chains; b) an intermediate temperature region in which the secondary bonds are sufficiently unstable so that complete relaxation has occurred before measurements can be obtained; the scission of primary valence

[1]The numbers in parenthesis refer to the literature citations at the end of this report.

measurable effects are obtained during the course of the usual laboratory experiment; and c) a high temperature region in which the relaxation of stress with time is associated with a chemical reaction which, through breaking of primary valence bonds in the network, severs the chains rapidly enough to be measured during the course of usual laboratory experiments. The high temperature region is that in which elastomers soften and/or harden and finally lose their rubbery characteristics. Oxygen has been shown to be necessary for the chain scission reaction. Several papers have described this fundamental experimental technique on stress-relaxation (11, 14, 16, 23) and creep (14, 23) for different elastomers.

Elastomers after being stretched or deformed for given lengths of time and then allowed to be released, do not return to their original dimensions completely. This is commonly known as permanent set. A dual molecular network exists in an elastomer in which the chains are of two kinds—those which are at equilibrium when the specimen is stretched and those which are at equilibrium when the specimen is unstretched and are generaly considered to cause permanent set. Cross linking and scission are thought to be responsible for permanent set. In creep tests with plasticized polyvinyl chloride Aiken, Alfrey, Janssen and Mark (17) have shown that the deformation taking place during creep is retarded elastic deformation rather than flow. It was observed that essentially all of the elongation was recovered provided enough time was allowed. It was pointed out that a three-dimensional gel structure existed even with solutions containing 90 to 96% plasticizer.

Basic principles

It seems advisable before proceeding to a discussion of basic principles to define the terms that apply to the various phenomena involved.

"Stress relaxation" is that decrease of stress with time which occurs when a constant strain or deformation is applied to a material. In most instances, a fixed elongation (tensile strain) is used.

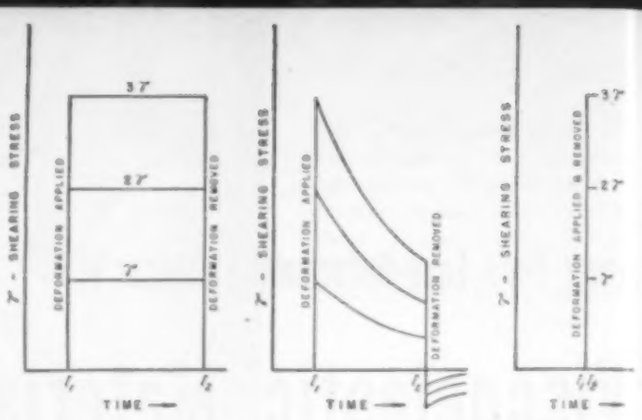
"Creep" is a continuing deformation under a fixed or constant load condition.

"Permanent set" is the deformation which remains upon the removal of the fixed load applied in a creep test, or the fixed strain applied in a stress relaxation test. This is usually taken to be a measure of the viscous flow that has occurred.

"Cold flow" is that deformation realized from a test carried out under constant compressive load conditions. It is merely a specific type of "Creep".

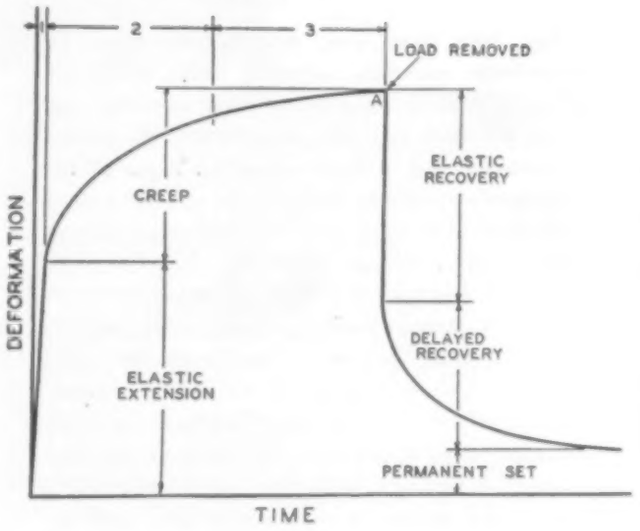
"Recovery" is the amount of deformation that disappears upon removal of the constant load or fixed strain initially applied to the material.

High polymers (18) when subjected to conditions of stress or deformation behave in a manner intermediate between that of a Newtonian fluid and an



1 — Graphical comparison of materials subjected to constant extension

2 — Complete plot of deformation vs time for rigid polymers (arithmetic)



idealized elastic solid. The Newtonian fluid supports a stress which is proportional to the time rate of change of strain:

$$\tau = \eta \frac{dv}{dy} \quad \text{..... (1)}$$

where dv is the velocity increment of one plane with respect to another over a distance dy, τ is the shearing force per unit area, and η is the coefficient of viscosity. When the stress is removed no recovery takes place. The ideal "elastic" solid has a strain that is independent of time and which is recovered instantaneously upon removal of stress:

$$T = G\gamma \quad \text{..... (2)}$$

where γ is unit deformation and G is modulus of elasticity in shear. Intermediate between these two types of behavior lies "plastic" flow. This may be represented by the following equation:

$$T = \psi \gamma f(t) \quad \text{..... (3)}$$

where ψ is a factor somewhat analogous to elastic

modulus but allows for plastic deformation and t is time. When the stress is removed a small amount of recovery may take place instantaneously followed by further recovery which may become complete as time goes on. The three types of behavior are graphically compared in Fig. 1.

The following relationship, due to Maxwell, describes the behavior of viscous bodies:

$$\frac{d\tau}{dt}=G\frac{d\gamma}{dt}-\frac{\tau}{\lambda} \qquad \text{.....(4)}$$

where λ is called the time of relaxation. The integrated form of this equation results in the following familiar relationship for stress relaxation, i.e., at constant deformation where $\frac{d\gamma}{dt}=0$:

$$\tau=\tau_0 e^{-\frac{t}{\lambda}} \qquad \text{.....(5)}$$

In general, polymeric materials when loaded at constant stress exhibit an initial elastic deformation followed by a deformation related to the relaxation properties of the material. The following equation qualitatively relates the factors involved:

$$\gamma=\frac{\tau}{G}+\int_0^t \frac{\tau}{G\lambda}\,dt \qquad \text{.....(6)}$$

It will be noted that if the polymer is loaded in a time interval very short in comparison with the relaxation time, the material will exhibit essentially elastic behavior.

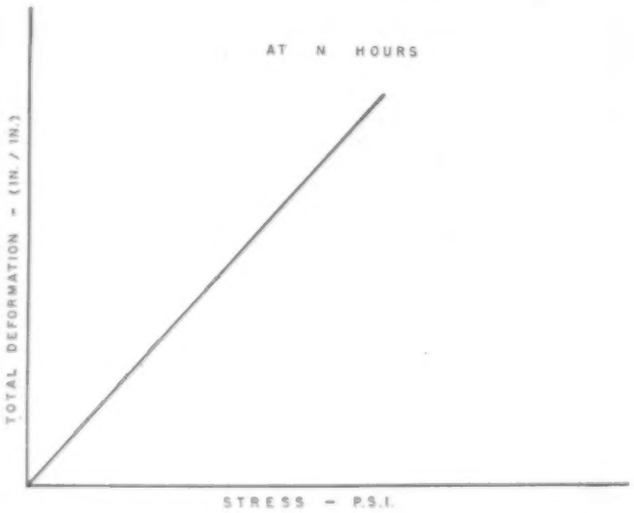
The general expressions developed by Maxwell to describe the deformation characteristics of polymeric materials have been found to apply in practice to only a few materials. Other investigators have found it necessary to derive equations which more adequately express the relationship between load and deformation. Thus, Boltzmann (19) in 1874 developed an equation relating load to deformation as a function of time. The basic assumption involved in this development is that the instantaneous deformation of a material exhibiting primary creep behavior can be divided into two parts: one, an elastic deformation; the other, a delayed or primary creep component. The expression is usually referred to as the superposition equation. The primary creep component depends on the entire past loading history; hence the term, superposition, i.e., total deformation, is simply a summation of deformations due to the various load effects.

The total deformation at time t due to a load P applied at zero time is given by:

$$y_t=\frac{FP}{E}\left[1+B\psi(t)\right] \qquad \text{.....(7)}$$

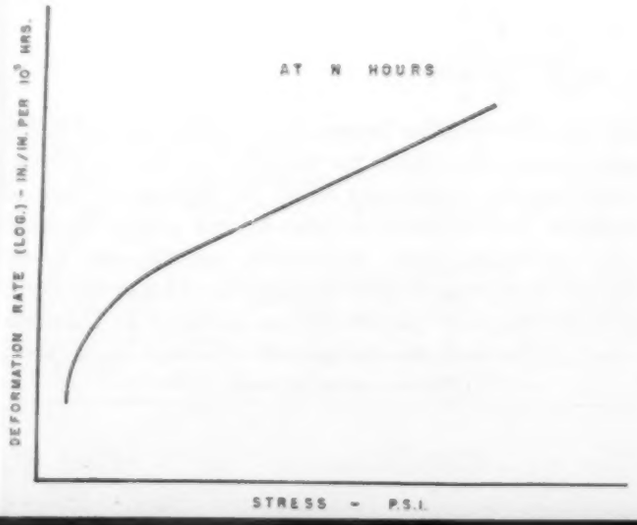
where ψ (t) is the creep function and increases from zero at zero time to a finite value (dependent on previous deformation of the specimen) at infinite time, F is a form factor (geometry of specimen), P is load applied, E is modulus of elasticity, B is a constant, and y_t is total deformation. Leaderman (19) indicates that this equation is of great value in instances where only primary creep is involved. It should be noted here that primary creep refers only to deformations which are completely recoverable.

Thus far this discussion has been limited to relationships which are essentially empirical in nature. The present trend is to study the behavior of polymeric materials under load in the light of rate processes. This represents a rather fundamental approach to the problem. Eyring's Activation Energy Theory for chemical reaction rates and for diffusion has been applied to the problem of the creep characteristics of metals by Kauzmann (9) and others, and to the creep of rigid thermoplastics by Kistler (10). The following equation relates the activation energy to the tensile creep rate; this equation is applicable only in the region where A $l\tau$ » k T (if the energy supplied by the shear force in activating the mole-



3 — Total deformation vs stress for rigid polymers

4 — Log deformation rate vs stress for rigid polymers



cule is very much larger than the thermal energy):

$$V=\frac{2}{3}\frac{\lambda}{L}\frac{kT}{h}e^{\frac{\Delta S^*}{R}}e^{-\frac{\Delta H^*}{RT}}e^{\frac{qA\tau l}{2kT}} \quad \text{..... (8)}$$

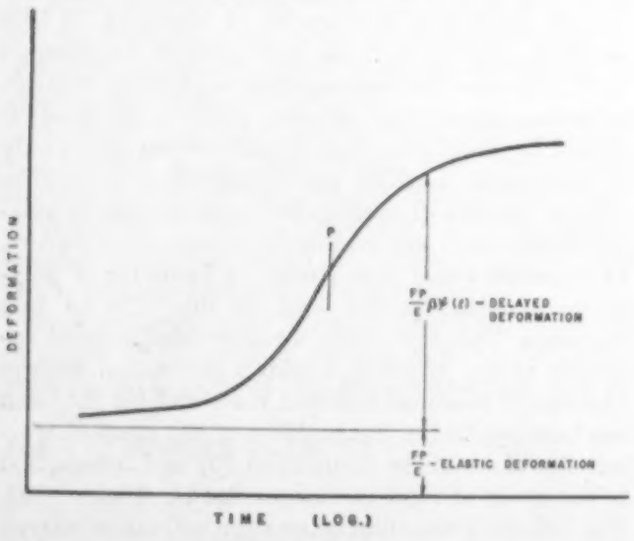
where v is the rate of creep, T is absolute temperature, τ is shear stress in pounds per square inch, k is the Boltzmann constant, h is the Planck constant, λ is the average distance in the shear direction moved by units of flow past one another in one jump, L is the average distance between layers of units of flow, A is projected area of each unit of flow in the shear plane, q is the stress concentration factor, l is the distance through which the shear stress acts in carrying the unit of flow from the normal to the activated state, ΔS^* is entropy of activation per mol, and ΔH^* is energy of activation per mol. The above equation applies only to the viscous flow region of creep behavior. It does not predict the manner in which a material will deform in the elastic and high elastic region, i.e., primary creep. This type of relationship could be used to calculate the permanent set that would take place in a creep test.

Somewhat different phenomena occur when elastomers are subjected to long time stress. Tobolsky and Andrews (14) have derived an equation which relates the stress and strain of an elastomer in terms of the concentration of chains in the network and the temperature:

$$f=SkT\left[\frac{l}{l_u}-\left(\frac{l_u}{l}\right)^2\right] \quad \text{..... (9)}$$

where: f is the stress, s is the number of network chains per cc. of the elastomer, k is Boltzmann's constant, T is the absolute temperature, l is the stretched length, and l_o is the unstretched length. Changes in the stress at constant temperature and constant strain are then caused by changes in the number of network chains per unit volume that are active in maintaining the stress. Changes in "s" can be measured either by keeping l constant and measuring the change in f; or, by keeping f constant and measuring changes in l. The first is termed stress relaxation and the second is termed creep. Both of these can be measured either continuously or intermittently.

5 — Semi-logarithmic plot of deformation vs time for rigid polymers



Tobolsky, Prettyman, and Dillon (16) measured the stress relaxation on a number of different rubbers over a wide range of temperatures and found that three temperature ranges could be distinguished: first, a low temperature range where the stress changes rapidly with time; second, an intermediate range where, for practical purposes, no change occurs in stress with time; and third, a high temperature range in which there is a decided decrease in stress as a function of time. To show the correlation that exists between stress relaxation and creep, Tobolsky and Andrews treated the data in an equivalent way by plotting s/s$_o$ as the ordinate for both. This represents the number of chains per cc. of the elastomer at a given time divided by the number of chains per cc. at zero time. Both kinds of data can then be turned into this form by use of the preceding equation. Rewriting the equation at zero time:

$$f_o=S_o kT\left[\frac{l_o}{l_u}-\left(\frac{l_u}{l_o}\right)^2\right] \quad \text{..... (10)}$$

and again at t:

$$f=SkT\left[\frac{l}{l_u}-\left(\frac{l_u}{l}\right)^2\right] \quad \text{..... (11)}$$

To get s/s$_o$ equation 11 is divided by equation 10. In stress relaxation l equals l_o. Therefore:

$$\frac{S}{S_o}=\frac{f}{f_o} \quad \text{..... (12)}$$

Thus for creep, Equation 13 can be derived from Equations 10 and 11:

$$\frac{S}{S_o}=\frac{\left[\frac{l_o}{l_u}-\left(\frac{l_u}{l_o}\right)^2\right]}{\left[\frac{l}{l_u}-\left(\frac{l_u}{l}\right)^2\right]} \quad \text{..... (13)}$$

In this case s/s$_o$ for intermittent creep has the same significance as it does for intermittent stress relaxation; but, in continuous creep for lightly vulcanized rubber, cross-linking is also taking place. Thus, if only scission were occurring, continuous creep would be identical with continuous relaxation. Even though the new chains are not stressed at the time they are formed, the elongation is always increasing;

(*Please turn to page* 183)

Paste Dispersions of Polyvinyl Chloride*

by CLAYTON F. RUEBENSAAL†

THE purpose of this investigation was to study German practices and general thinking used in the manufacture and application of polyvinyl chloride paste dispersions.[1] Properties required for an acceptable resin, type and quantity of plasticizers used in paste compositions, methods, and equipment employed to compound them and the techniques and machinery used to apply the pastes were all subjects for review.

The use of paste dispersions of polyvinyl chloride in Germany had reached a consumption rate of approximately 300 metric tons per month during World War II. This figure could have been doubled and still utilized if resin and plasticizer had been available.

*PB 77673, Technical Industrial Intelligence Div., U. S. Department of Commerce.

†Technical Director, Chemicals Div., The Glenn L. Martin Co.

[1]Deutsches Reichs-Patent No. 685,839, assigned to Kotitzen Ledertuch- und Wachstuch-Werke. Deutsches Reichs-Patent No. 742,329, assigned to I. G. Farbenindustrie A. G. British Patent No. 500,298, assigned to I. G. Farbenindustrie A. G.

Table I.—Designations of Germany's Polyvinyl Chloride Resins.

Name	*K value*[a]	*Catalyst*
1. PCU-R (Rohre)[b] Used for rods and pipes	60-63	Potassium persulfate
2. PCU-F (Folie) Used for hard foils; also for after chlorination	60-65	Potassium persulfate
3. PCU-L (Luvitherm) Same as F but with IG Wax E added	60-65	Potassium persulfate
4. PCU-GN (Gummi niedrig) Lower molecular weight than G for elastomeric uses	65-70	Potassium persulfate
5. PCU-K (Kabel) Wire insulation	65-75	Hydrogen peroxide
6. PCU-G (Gummi) Elastomeric uses	70-75	Potassium persulfate
7. PCU-P (Pasten) Same as G but found by plant test to be especially suited for pastes	70-75	Potassium persulfate
8. Vinnol H (hoch)[c] Elastomeric uses	70-75	Benzoyl peroxide
9. PCU-GH (Gummi hoch) Higher molecular weight than G for elastomeric uses	ca. 75	Potassium persulate
10. Vinnol H H (hoch hoch) Shoe soles	ca. 80	Benzoyl peroxide

[a]See MODERN PLASTICS 23, 157 (Nov. 1945) for a definition of this molecular weight designation. According to an agreement reached in Bitterfeld in 1942, this determination is to be made at 20° ±0.05° C. with a solution of 1.000 gram of polymer dissolved in cyclohexanone to 100 ml. at 20° C. and a Hoeppler viscometer with a sphere chosen so that the time of fall is over 30 seconds (See PB 31253).

[b]PCU—trade name of I. G. Farbenindustrie designating polyvinyl chloride unchlorinated.

[c]Vinnol—trade name of Alexander Wacker's polyvinyl chloride.

Paste dispersions had virtually replaced solvent coating of fabrics in Germany and had opened up new methods of employing plasticized polyvinyl chloride that had not been formerly possible. The state of development of these dispersions was much more advanced and the range of applications of greater scope than that used in the United States.

The shoe sole casting machine of Spoehn and Knoell was the only special equipment in Germany designed specifically for paste application. The remainder of the mixing and fabricating machinery compares with the standard plastics processing equipment available in the United States. It was therefore thought inadvisable to report dimensions or operation of these in detail except as the operation was specific to paste use.

Properties of paste dispersion resins

A basic definition for a paste is: a composition comprising a high molecular weight polyvinyl chloride resin (having certain prescribed limits of particle size and density) mechanically dispersed in an organic plasticizer to yield a stable, high viscosity suspension at room temperature, which can later be raised to an elevated temperature and so effect dissolution to produce homogeneous, high strength, elastomeric products.

Contrary to popular belief, the polyvinyl chloride resin type PCU-P used for pastes is not a polymer specially prepared for this one application. Despite ideal control conditions the polymerization of any monomeric substance yields products of varying density, average molecular weight, molecular weight distribution and particle size. This variance occurs not only in batch reactions but also, although to a lesser extent, if the process is continuous. Subsequent precipitation and/or drying and grinding operations tend to vary the nature of the product even more. This quality variance existed in all the polyvinyl chloride resins produced by the I. G. Farbenindustrie and Alexander Wacker firms.

Polymerization conditions were varied to get the various types with polymer ranges shown in Table I. It was, however, common for a plant to obtain the next higher or lower viscosity range resin than that of a batch prepared previously under identical conditions.

Work on polyvinyl chloride pastes was started in 1931 at Bitterfeld. The first large scale production of pastes began in 1938 at that place. Initial research was carried out with GN, G and GH grade resins. These experiments showed that a high K value and

Table II.—Viscosity Data on German Plasticizers[a].

Plasticizer	*Rating as primary plasticizer for paste applications*	*Viscosity at 20° in centistokes*	*Slope constant of visc.-temp. curve* 30—50° C.	50—70° C.
Mesamoll I	Excellent	380	4.22	4.04
Palatinol HS	Good	74	4.35	4 39
Tricresyl phosphate	Good	74	4.47	4.21
Dibutyl phthalate	Poor	20.1	4.08	4.21

[a]K. Leilich, Kolloid Zeitschrift 99, 107 (1942).

a high M number[2] were not particularly good properties to have for a resin that was to be used in paste manufacture. An intrinsic viscosity of 1.0 to 1.1 and an M number of about 30 were found to be optimum values.

PCU-G, being the closest technical grade to this was therefore selected, and continues to be used. The letter designation P was assigned in February 1944. This letter was used to segregate batches of G, found by a simple gelatination test to be especially well suited for pastes. The plant test consisted merely of mixing 50 parts of resin with 50 parts of the tricresyl phosphate and observing if satisfactory flow conditions were obtained.

In addition to the molecular weight and the molecular weight distribution specifications given above, the polymer powder should have a high bulk density. The resin particles should have also the minimum value possible for their surface area-volume ratio and a diameter of less than 50 microns. The spherical particles produced by the Nubilosa spray drier met these requirements ideally. The conditions of air pressure, latex feed, and drying temperature of the Nubilosa were controlled to produce not only a high density spherical particle but one that in addition had a very thin surface skin of fused resin. It was claimed that this permitted the particle to remain suspended and insoluble in the plasticizer until the fusion temperature was reached.

[2]The M number is determined by dissolving 1 ±0.01 gram in a solvent consisting of one part epichlorohydrin and three parts chlorobenzene; the specific gravity, 20/20, of the solvent mixture is 1.1. The polymer is suspended in the solvent in a test tube, 22 to 28 mm. in diameter and 180 to 200 mm. in length, with frequent stirring at room temperature for about 15 minutes. Solution is completed at 80° C. in a waterbath. The solution is cooled with stirring within about 3 min. to 20° C. The beginning of gelling, denoted by drops detached from the thermometer drawing out into threads, should occur after 3 min., calculated from the time the solution reaches 20° C. The M number is the number of ml. of solvent mixture required to produce gelling under the preceding conditions, multiplied by 1.1 (see PB 31253).

The product dried on an Imperial drier (similar to a continuous Oliver) was found to be so soft that it readily absorbed plasticizer and produced a gel instead of a fluid paste. Resins dried on Escher Wyss or Haubolt centrifuge were conversely found to be so hard that the particles did not go into solution rapidly at the fusion temperature. This resulted in non-homogeneous, low strength articles.

The resin now being prepared by I. G. Farbenindustrie A. G. at Ludwigshafen, as PCU-G, is dried on an Escher-Wyss drum drier. Here the emulsion is deposited in a thin film on a slowly revolving, heated iron roll. Although the product is not so good as that prepared in the Bitterfeld Nubilosa, it is being used commercially for the preparation of pastes.

The Vinnol resins produced by Wacker had too high a molecular weight and too large a particle size for their successful adaptation in pastes. Small scale experiments on some of their recent air separated resin, classified to a very fine particle size for use in Luvitherm work at Gendorf, showed this grade to be more suitable for pastes. Mixtures of Vinnol HH with PCU-P up to 50% could be utilized for the preparation of stable plasticizer-resin dispersions.

Properties of paste dispersion plasticizers

Generally speaking, the purity and color of the German plasticizers were not comparable to those obtainable in the United States. However, many new types now available, but not in commercial quantities, had exceptionally interesting properties.

(*Please turn to page* 202)

Table III.—Bitterfeld Paste Formulations (Compositions given in parts by weight).

Paste designation	*PCU-P resin*	*Mesamoll*		*Tricresyl phosphate*	*Palatinol F*		*Palatinol KF*	*Silica powder*
Paste F for cheap general purpose use	50	50	or	(50)				10
Paste M for general purpose use	50	50	or	(50)				
Paste K for cold resistance	50	20			30	or	(30)	
Paste C for harder products	60	40	or	(40)				

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General

MAJOR ADVANCES IN PLASTICS DURING 1947. J. W. Underwood. Mech. Eng. *70*, 298-300 (Apr. 1948). The progress in plastics during 1947 is reviewed. Seventy-two references.

ADVANCES IN RUBBER DURING 1947. V. A. Cosler and S. W. McCune, 3rd. Mech. Eng. *70*, 307-12 (Apr. 1948). The progress in rubber during 1947 is reviewed; 195 references.

PLASTIC HIGHLIGHTS IN 1947. P. O. Powers. Chem. Eng. News *26*, 20-1 (Jan. 5, 1948). Some developments in the plastics field in 1947 are reviewed.

TEXTILE FIBER DEVELOPMENTS. R. E. Wright and M. Harris. Chem. Eng. News *26*, 21-3 (Jan. 5, 1948). The developments in the textile industry in 1947 are reviewed.

STIMULATION OF PLASTICS TECHNOLOGY BY GERMAN DISCLOSURES. J. M. DeBell and H. M. Richardson. Ind. Eng. Chem. *40*, 651-4 (Apr. 1948). This is a review of the significant contributions to plastics technology that have come from Germany and a discussion of the adaptations and improvements that have been made in the United States.

Materials

MANUFACTURE OF RESOLS. L. Bettelheim and K. Nihlberg. British Plastics *20*, 50-9, 108-18 (Feb., Mar. 1948). The synthesis of phenolic resins from phenol and formaldehyde was studied in detail. The periods in the reaction time are classified as 1) heating, 2) ripening, 3) post-ripening, 4) evaporation, 5) concentration, and 6) cooling. The resin at the various stages can be characterized by refraction index, specific gravity or viscosity measurements.

VINYL AND ALLYL CROTONATES—NEW MATERIALS FOR PLASTICS. Plastics (London) 12, 82-4 (Feb. 1948). The polymerization of vinyl and allyl crotonates and their copolymerization with styrene and various vinyl compounds is described. The properties of the resins formed are described briefly.

Molding and fabricating

MOLDING A DOLL. British Plastics *20*, 133-4 (Mar. 1948). The molding of a hollow-cast doll from polyvinyl chloride paste is described.

PRODUCTION OF ELECTRO-FORMED MOLDS. P. Spiro. British Plastics *20*, 124-9 (Mar. 1948). Plastics (London) *12*, 132-6 (Mar. 1948). The production of metal molds for plastics by an electroforming process is described.

FLEXIBLE MOLDS FROM VINYL COMPOUNDS. H. Reichard. Plastics (London) *12*, 113-17, 164 (Mar. 1948). A hot melt vinyl plastic to replace gelatin in the manufacture of flexible molds for plaster-of-paris, cast resins and cement is described.

Applications

BUILDING BOARD FROM WOOD WASTE. Plastics (London) *12*, 5-9 (Jan. 1948). A plastic board or panel is made from waste wood chips and sawdust bonded together with a urea-formaldehyde resin.

LIGHTNESS AND STRENGTH COMBINED IN METAL-WOOD COMPOSITES. K. Rose. Materials & Methods *27*, 70-3 (Feb. 1948). Several applications of wood-metal composites in transportation equipment are described. The composites are bonded with a synthetic resinous adhesive made by combining elastomeric and phenolic resins.

POLYETHYLENE CLOSURES. Modern Packaging *21*, 102-6, 190 (Mar. 1948). Various closures molded of polyethylene are described. The high chemical resistance and flexibility of this plastic make it an excellent material for this application.

NEW PLASTIC TABLEWARE. H. Turnwald. Plastics (London) *11*, 571-4 (Nov. 1947). German designs of plastic tableware molded of urea-formaldehyde plastics are described and illustrated.

REQUIREMENTS AND PROPERTIES OF ADHESIVES FOR WOOD. R. A. G. Knight. Dept. Sci. Ind. Research, Forest Products Research Bull. No. 20, 26 pp. (1946). The various types of adhesives for wood are described.

CROSS-LAMINATED OAK. E. G. Stern. Trans. ASME *70*, 123-33 (Feb. 1948). Exposure conditions which may occur in service were found to be a limiting factor for the cross-laminating of oak. Exposure to 48-hr. soaking of panels previously conditioned to 9% moisture content was more severe than exposure to 48-hr. oven-drying at 97° C. Phenol-resorcinol-resin glue proved to be more desirable than urea-formaldehyde-resin glue for cross-laminating panels subjected to extreme exposure conditions. For panels with a minimum of internal stresses due to extremes in exposure, such as thin cross-laminated panels with thin face plies, urea-formaldehyde-resin glue can be used satisfactorily.

Properties

A NEW INTERPRETATION OF HEAT DISTORTION DATA OF PLASTICS. L. S. Moody and K. B. Goldblum. ASTM Bulletin *1948*, No. 150, 55-8 (Jan. 1948). The graph of the log of deflection in mils versus the log of the absolute temperature with regard to heat distortion data has led to some interesting observations. A marked difference between the behavior of thermoplastic and crosslinked materials is shown. Interpretations are presented for

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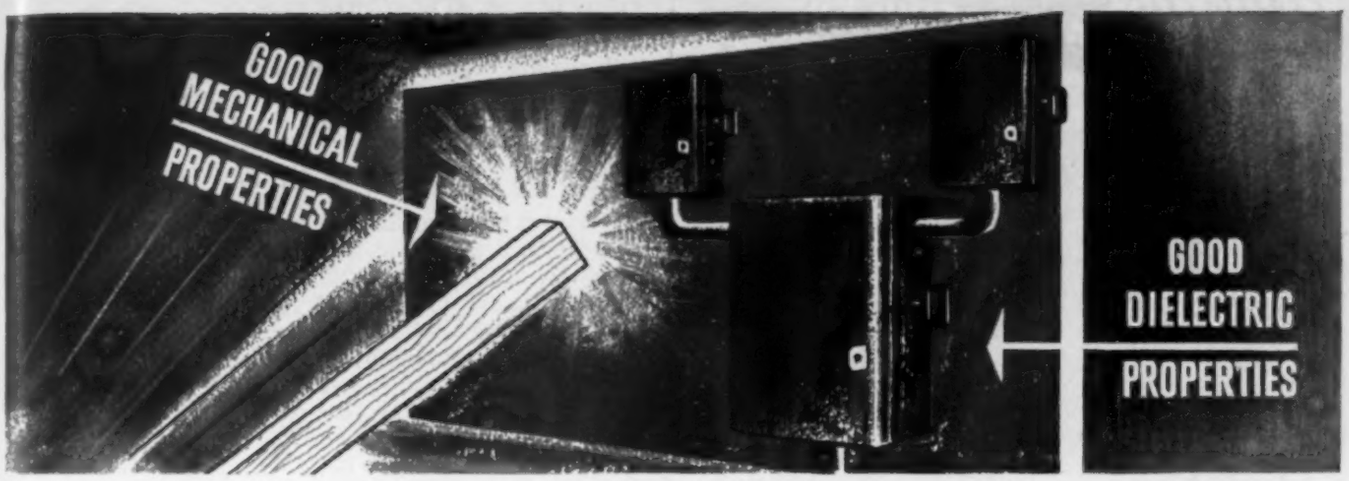

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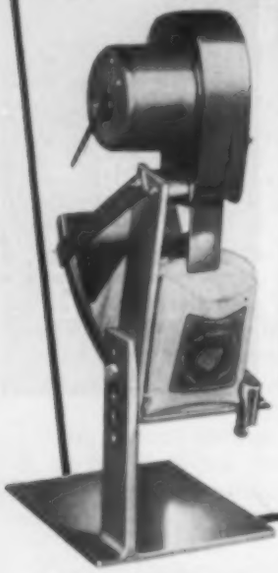

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SOME FUNDAMENTALS OF GLASS ADHESION. F. Moser. ASTM Bulletin *1948*, No. 150, 51-5 (Jan. 1948). The results of tests on joints made by bonding glass to glass with various organic chemicals and resins are reported. It is shown that functional groups of molecules are important influencing factors for obtaining adhesion.

Testing

DETERMINATION OF MONOMER IN POLYSTYRENE. J. J. McGovern, J. M. Grim, and W. C. Teach. Analytical Chem. *20*, 312-14 (Apr. 1948). An ultra-violet spectrophotometric procedure was developed for the rapid and accurate determination of monomer in polystyrene. For the same analysis a method dependent upon the solubility of the sample in methanol was also devised. Results of the two methods are compared. It is shown that a large reproducible difference in the answers obtained by the two procedures can be taken as indication of the presence of an additive in the polystyrene.

MEASUREMENT OF INTERNAL DOUBLE BONDS IN POLYMERS BY PERBENZOIC ACID ADDITION. A. Saffer and B. L. Johnson. Ind. Eng. Chem. *40*, 538-41 (Mar. 1948). A procedure is described for determination of the amount of internal double bonds in polymers containing 70% or more internal linkages. The method is based on the more rapid addition of perbenzoic acid to internal double bonds which form by 1,4 polymerization than to vinyl double bonds resulting from 1,2 polymerization. The optimum reaction conditions are 25% excess of perbenzoic acid in chloroform solution reacting at 6° C. Several preparations of GR-S, polybutadiene, polyisoprene, polydimethylbutadiene, and natural rubber were measured with a precision of 1 percent.

Chemistry

PYROLYSIS OF HIGH POLYMERIC HYDROCARBONS. R. B. Seymour. Ind. Eng. Chem. *40*, 524-7 (Mar. 1948), The stability of high polymeric hydrocarbons toward depolymerization as determined by the lowest temperature at which volatile products are produced was shown to be as follows: polyethylene > polystyrene > polyisobutylene. A mechanism of the depolymerization is presented in which the role of free radicals is emphasized. The type of decomposition products obtained in the pyrolysis of polymeric hydrocarbons is shown to be a function of the structure of the hydrocarbon chain and the volatility of the products of pyrolysis.

CONTINUOUS POLYMERIZATION IN GERMANY. R. D. Dunlop and F. E. Reese. Ind. Eng. Chem. *40*, 654-60 (April 1948). Three commonplace thermoplastic materials are produced by I. G. Farbenindustrie by continuous polymerization methods. These include the mass polymerization of styrene and vinyl acetate, and the emulsion polymerization of vinyl chloride. Information concerning these processes, which has been scattered through various publications of the Office of Technical Services, is summarized and discussed with emphasis on the equipment and engineering features. The three processes are similar. In general the equipment has the form of tall slender autoclaves into which monomer is added at the top and the polymerized product drawn from the bottom. The increase in specific gravity as polymer is formed is utilized to obtain a separation of polymer from monomer.

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U.S. PLASTICS PATENTS

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OPTICAL LAP. L. M. Hicks (to Eastman Kodak Co.). U. S. 2,434,614, Jan. 13. An abrading lap for the cold working of solid optical material comprising a working surface of a cellulose derivative molding compound.

STRAIN GAGES. E. E. Simmons, Jr. U. S. 2,434,628, Jan. 13. An electrical resistance device is prepared by wrapping a continuous solid resistance filament around a piece of plastic material, then placing an etchable membrane over said filament and finally applying heat and pressure to the membrane and material so as to embed the filament in the plastic material.

POLYETHYLENE STABILIZER. G. H. Latham and D. E. Strain (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,434,662, Jan. 20. A composition comprising a solid ethylene homopolymer and from 0.01 to 5 parts of a compound such as diphenylol propane or dicresylol propane.

PLASTIC HOUSING. W. P. Mason (to Bell Telephone Laboratories, Inc.). U. S. 2,434,666, Jan. 20. In combination, an electromechanical transducer, non-corrosive liquid having the same impedance characteristics as water in which said transducer is immersed and a thin wall housing for retaining said liquid, said housing comprising a plastic also having the same impedance characteristics as water.

KERATIN. R. L. Evans. U. S. 2,434,688, Jan. 20. Modified keratin is prepared by reducing with a non-polar mercaptan in an aqueous solution having a pH above 3 and below 13.5, dissolving in an aqueous solution having a pH between 9.0 and 13.5 and precipitating in an acid bath.

CONTINUOUS MILLING. W. R. Marshall (to Bakelite Corp.). U. S. 2,434,707, Jan. 20. An apparatus for milling and conveying a plastic comprising, in combination, a pair of parallel horizontal rolls having intermeshing left- and right-handed V-shaped helical threads to form a bite for the passage of the plastic, and a housing enclosing and supporting same.

IMPREGNATED CELLULOSE. H. Dreyfus, D. Finlayson, and R. G. Perry (to Celanese Corp. of America). U. S. 2,434,912,-3, Jan. 27. Cordage is manufactured by impregnating a rope of regenerated cellulose fibers with a solution of a heavy metal naphthenate and a substance such as a water-resistant ester or ether of cellulose in a hydrophobe liquid at a temperature of at least 120° C.

FLOOR COVERING. H. R. Woerner (to Armstrong Cork Co.). U. S. 2,434,974, Jan. 27. A floor or wall covering comprising a wearing surface of a siccative oil composition and a water-resistant, flexible, fibrous foundation containing as non-staining impregnating ingredients, the dried residue of a mixture of tall oil, a plasticizer, and a solvent.

SHOE. J. A. Desbiens. U. S. 2,435,131, Jan. 27. A shoe, the sole of which comprises alternate plastic layers.

ORGANO-SILICON POLYMERS. R. R. McGregor and E. L. Warrick (to Corning Glass Works). U. S. 2,435,147, Jan. 27. The method of polymerizing a polymeric diorgano siloxane in which one of two radicals attached to silicon is an alkyl and the other is alkyl or aryl, comprising reacting with phosphorous pentoxide or phosphoric acid.

CHLORINATED SILICON POLYMERS. R. R. McGregor and E. L. Warrick (to Corning Glass Works). U. S. 2,435,148, Jan. 27. Chlorine is passed through a cyclic dimethyl siloxane polymer, the resultant polymer is mixed with chain polymers of dimethyl silicate having terminal hydroxyl groups and the mass is heated.

MOLDING. T. Wachs and J. M. Shutt (to Radio Corp. of America). U. S. 2,435,170, Jan. 27. A die holder for molds useful in molding plastic articles.

INDEX GUIDE. C. E. Jones (to Rockwell-Barnes Co.). U. S. 2,435,221, Feb. 3. An index guide of plastic material.

POLYMERIZATION. M. D. Mann (to Jasco, Inc.). U. S. 2,435,228, Feb. 3. An apparatus for producing solid polymers including means for agitation by kneading action.

POLYETHYLENE. D. E. Strain (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,435,245, Feb. 3. A composition comprising a homopolymer of ethylene containing diphenylamine acetone.

PHOSPHORUS CONTAINING RESINS. A. D. F. Toy (to Victor Chemical Works). U. S. 2,435,252, Feb. 3. Method of producing phosphorus-containing resins by heating an aromatic halo-phosphorus compound with a polyhydric aromatic compound.

EXTRUSION. N. Lester (to Lester Engineering Co.). U. S. 2,435,282, Feb. 3. An apparatus for pressure-extruding of plastic materials.

DIOLEFINE POLYMERS. F. J. Soday (to United Gas Improvement Co.). U. S. 2,435,411-2, Feb. 3. The resinous polymer obtained by polymerizing light oil fractions in the presence of a metallic halide catalyst and a stabilizing agent comprising the reaction product of acetone with an aromatic amine.

ALKYD RESINS. T. W. Evans and D. E. Adelson (to Shell Development Co.). U. S. 2,435,429, Feb. 3. A resin formed by reacting 2-(hydroxy-methyl)-1-propen-3-ol with a dicarboxylic acid anhydride.

POLYVINYL FILMS. M. R. Radcliffe (to Firestone Tire and Rubber Co.). U. S. 2,435,464, Feb. 3. A self-support-

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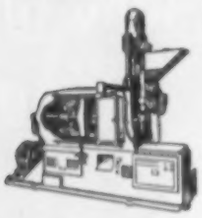

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ing film of vinyl chloride-vinylidene chloride copolymer having enhanced water resistance due to inclusion therein of dicetyl ether.

POLYAMIDES. H. M. Teeter and J. C. Cowan (to U. S. A.). U. S. 2,435,478, Feb. 3. A polyamide obtained by reacting a polymeric fatty acid or ester with polyoctadecapolyenylamine at 150 to 250° C.

OVERSHOE. E. Wheaton. U. S. 2,435,485, Feb. 3. An overshoe seamed to stiffen a plastic upper.

COLLAR. E. C. Pfeffer, Jr. and L. M. Miller (to Cluett Peabody and Co.). U. S. 2,435,509, Feb. 3. A shirt collar containing an interlayer thin film of flexible plastic.

POLYVINYLIDENE FLUORIDE. T. A. Ford and W. E. Hanford (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,435,537, Feb. 3. A process for obtaining orientable polyvinylidene fluoride comprising heating vinylidene fluoride in the presence of a catalyst and under pressure.

PHENOLIC ALKYD RESINS. L. Coes (to Norton Co.). U. S. 2,435,554-5, Feb. 3. A casting mixture made by reacting a direactive phenol, pentaerythritol diformal, and a dicarboxylic acid anhydride, and an abrasive molding mixture containing said resin.

WIRE COATING. M. Albanese (to Columbia Protektosite Co., Inc.). U. S. 2,435,567, Feb. 10. A method for molding flexible elongated articles in which a narrow plastic sheath encases a wire core.

TEXTILE TREATMENT. A. Landolt (to Soc. Chemical Industry in Basle). U. S. 2,435,591, Feb. 10. Treating textiles with aqueous solutions of resinous reaction products of formaldehyde and a nitrogenous material such as urea, melamine, and the like.

DRUM PEELER. W. W. Loewy. U. S. 2,435,592, Feb. 10. A drum peeler for grains and the like comprising a rotatable drum and housing therefor, the surface of the drum comprising a grid-shaped covering of resinous material.

MOLDING. M. Bean. U. S. 2,435,643, Feb. 10. The method of making a pattern of a flexible resilient thermoplastic.

COPOLYMER. A. M. Clifford (to Wingfoot Corp.) U. S. 2,435,674, Feb. 10. A synthetic rubber prepared by polymerizing an aqueous emulsion of a mixture of butadiene-1,3 and ethyl α-phenylacrylate.

HALOSTYRENE POLYMERS. C. H. Basdekis (to Monsanto Chemical Co.). U. S. 2,435,767, Feb. 10. A composition comprising a polymeric halogenated styrene and dicyclohexylamine or one of its alkyl substitution products.

VINYL POLYMER. L. E. Cheyney and C. R. Parks (to Wingfoot Corp.). U. S. 2,435,769, Feb. 10. A color stable resin comprising a polymer of vinyl chloride and formamide.

COPOLYMER. A. M. Clifford and J. G. Lichty (to Wingfoot Corp.). U. S. 2,435,773, Feb. 10. A rubberlike copolymer of butadiene and acrylonitrile plasticized with isobutyl β-isobutoxy propionate.

(Please turn to next page)

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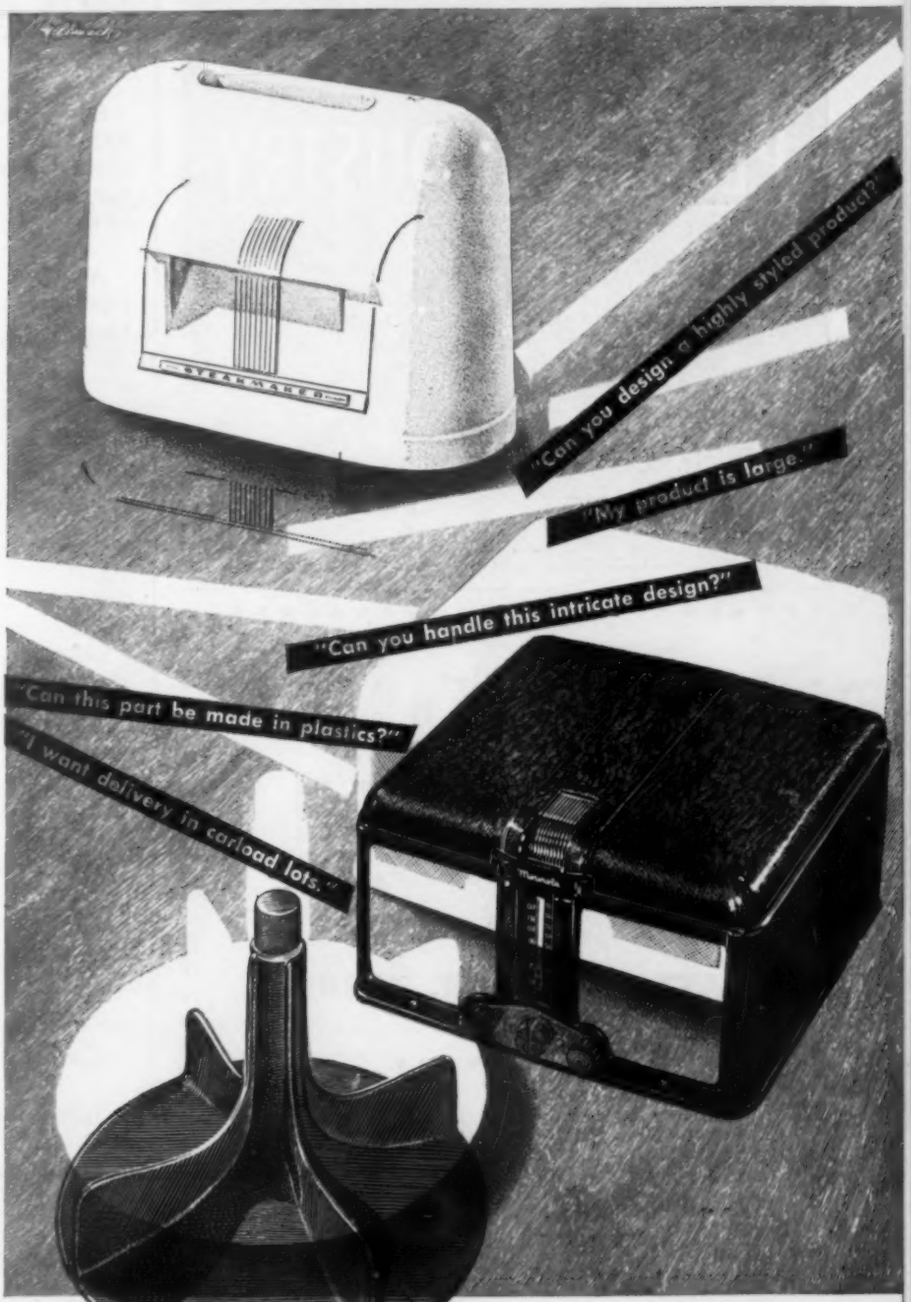
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QUATERNARY AMMONIUM POLYACRYLATES. F. J. Glavis and H. T. Neher (to Rohm and Haas Co.). U. S. 2,435,-777, Feb. 10. A process for preparing quaternary ammonium polyacrylates from a quaternary ammonium hydroxide and a saponifiable ester of polyacrylic acid.

POLYMER RECOVERY. A. J. Garcia (to Wingfoot Corp.). U. S. 2,435,778, Feb. 10. A method of recovering a water-insoluble solid polymerized olefin from aqueous emulsion containing sodium lauryl sulfate by precipitation with a potassium salt.

COPOLYMER. J. R. Long (to Wingfoot Corp.). U. S. 2,435,790, Feb. 10. A copolymer of butadiene-1,3, isoprene, or 2,3-dimethyl butadiene-1,3, with a cyanostyrene.

SHOE UPPERS. E. G. Reed (to Wingfoot Corp.). U. S. 2,435,797, Feb. 10. A shoe upper prepared by covering a last with a flat fabric of heat-shrinkable plastic strands fastened to a shoe sole and heating to cause it to shrink to the last.

ADHESIVE. N. G. Tompkins (to Dewey and Almy Chemical Co.). U. S. 2,435,909, Feb. 10. A liquid adhesive comprising an aqueous dispersion of a polyvinyl acetate and a pine wood extract resin.

TRIPACK FILM. J. C. Crawford. U. S. 2,435,957, Feb. 17. A tripack film comprising a transparent base, a blue sensitive emulsion layer, and a rear layer, said layers bonded with a polyvinyl acetate adhesive.

PRINTING INK. H. J. Wolfe and P. W. Greubel (to American Can Co.). U. S. 2,435,992, Feb. 17. A quick drying printing ink consisting of cellulose nitrate or ethyl cellulose, 2-ethylhexyl alcohol, wetting agent, and a pigment.

MOLDING POWDER. H. Dreyfus, J. H. Rooney, and B. Shaw (to Celanese Corp. of America). U. S. 2,435,999, Feb. 17. A process for preparing molding powder of cellulose ester containing tricresyl or triphenyl phosphate.

RESIN COMPOSITION. I. C. Matthews and W. F. Lynch (to Eastman Kodak Co.). U. S. 2,436,048, Feb. 17. A reaction product of terpinene, maleic anhydride, a hydrogenated coumarone-indene, and polystyrene.

MOLDING. C. S. Dewey, Jr. (to Shaw Insulator Co.). U. S. 2,436,065, Feb. 17. An apparatus for molding telephone hand sets of organic plastic material.

RESIN. A. F. Smith (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,436,080, Feb. 17. A composition comprising an intimate mixture of a curable urea-aldehyde resin and a hydrolyzed ethylene-vinyl ester copolymer.

CELLULOSE PLASTIC. L. W. A. Meyer and W. M. Gearhart (to Eastman Kodak Co.). U. S. 2,436,116, Feb. 17. A cellulose organic ester plastic, containing as stabilizer against ultra-violet light, resorcinol monobenzoate.

MOLDING. G. F. Rostler. U. S. 2,436,122, Feb. 17. An injection molding machine for plastic materials.

VINYL POLYMERS. B. W. Howk and R. A. Jacobson (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,436,144, Feb. 17. A vinyl trifluoroacetate polymer

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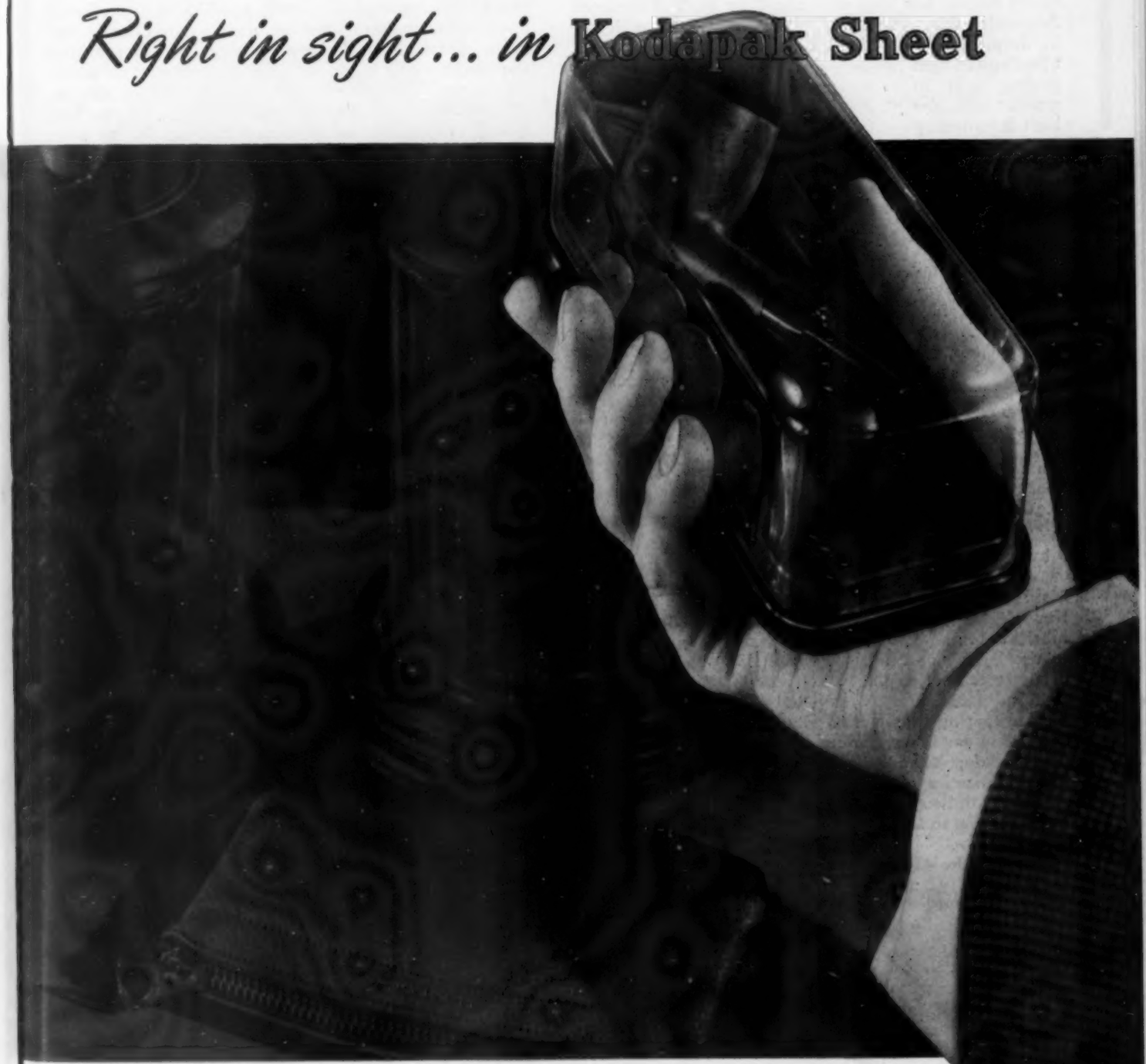

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NEW MACHINERY AND EQUIPMENT

Heat sealer and edge gluer—An electronic heat sealer, Model No. 12, has been announced by W. T. LaRose & Associates, Inc., Troy, N. Y. Measuring 14 in. wide, 23 in. deep, and 28 in. high, Model No. 12 is a packaged electronic heat sealing unit in which both the high frequency generator and the air operated electrodes are Thermall engineered. The unit is capable of making seals up to a maximum total length of 12 in. on either rigid or flexible plastic sheeting materials. Interchangeable electrodes are available for sealing plastic folders, envelopes, pouches, and other flat articles; for rectangular boxes and covers, two corners at one time; and for cylindrical tubes and containers.

The company's Wood Div. has announced an edge gluer, Monarch I, capable of handling wood panels up to 38 by 62 in. in area and 2 in. in thickness. It has a 5 kw. electronic heat generator.

Mold lubricant—Price-Driscoll Corp., 270 Broadway, New York 7, N. Y., has announced Bomb-Lube, a mold lubricant marketed in a self-propelling container similar to the DDT bug bombs. By depressing the valve top of the container, a fine penetrating mist will apply a uniformly thin film to mold surfaces. Tests have indicated that up to 35 cycles per application are possible depending on mold contour and the plastic material being molded. The lubricant is clear and will not mar or discolor plastics of any hue. It is said to reduce the coefficient of flow friction between die and plastic, permitting shots to fill out at lower injection pressures.

Polishing lathe—The Hanson-Van Winkle-Munning Co., Matawan, N. J., has announced that its Type MI and Type MS polishing lathes, in 3, 5 and 7½-hp. sizes, can now be supplied with variable speed arrangement. Any speed between 1800 and 3600 r.p.m. may be obtained. A variable pitch motor pulley and a single wide "V"-type belt govern the spindle speed. The calibrated control moves the motor and pulley assembly which changes drives centers, with the belt tension automatically maintained. Magnetic starters are supplied.

Portable heating and cooling system—A portable, self-contained Dowtherm heating and cooling system is being offered by Blaw-Knox Co., Blawnox, Pa. It consists of a 100,000 Btu. per hr. electro-vapor generator, a 100-gal. surge tank, a 50-sq. ft. cooler, a cooling pump for circulation of the liquid Dowtherm, a charge of "A" heat transfer fluid, and instruments and framework complete with control panel. Design working pressure for the vapor generator is 60 p.s.i. For applications where heating only is required, the company offers a 100,000 Btu. per hr. standard electrical vaporizer.

Measuring head—A new type measuring head for instruments measuring and controlling roll surface temperatures of calenders, dryers, and similar roll-type machines has been announced by the Foxboro Co., Foxboro, Mass. In operating ranges between —40 and +350° F., and at all ordinary operating speeds, continuous temperature measurement is assured within 2°. The measuring head is a small box-like unit faced with low-friction material and containing a resistance element contacting a T-shaped spring. Pressure against the machine roll is constant, but so light that no marking occurs. The company has issued Bulletin 405 describing and illustrating recorders and controllers, typical installations, and the new type measuring head.

Pyrometer—A pistol grip contact type pyrometer, Model 102, for measurement of the temperature of stationary, revolving, flat, curved, metallic, and non-metallic surfaces has been introduced by Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 15, Calif. This self-contained instrument may be used in plastic molding, die casting, electric appliances, for measuring the temperature of bearings, platens, rolls, tanks, pipes, cylinders, steam lines, heat sealing machines, etc. It has an accuracy of 2% of full scale value. In the lower ranges, automatic cold-end compensation is furnished; in the higher ranges manual compensation is normally provided. The pyrometer is available in eight standard ranges from 0-300° F. to 0-1200° F., or centigrade equivalents.

Drill-reamer—Severance Tool Industries Inc., 638 Iowa St., Saginaw, Mich., is now offering high speed drill-reamers in five standard sizes: 3/16, ¼, ⅜, ½, and 9/16-in. diameters. This dual-function tool is specially recommended in radial drill press operations where second positioning is no longer required for reaming. The drill section provides for efficient drilling through materials of any thickness up to that equalling their diameter. The reamer section is designed with teeth so arranged as to preclude chatter and to expel chips into the main flutes of the tool. Drill-reamers of solid carbide or with longer than standard pilot drills may be obtained by special order.

Time-schedule controller—A new type TAG time-schedule controller which can be synchronized with any system of air-operated semi-automatic temperature and pressure control now in use to make the process fully automatic has been announced by C. J. Tagliabue Corp. (N. J.), 614 Frelinghuysen Ave., Newark 5, N. J. It allows such automatic control at relatively low cost and without disposing of presently installed equipment. All valves—steam, air, drain, overflow, and cooling water—

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are operated as the process may require and manual adjustments are eliminated. Additional information may be obtained by writing for a company bulletin, No. 1283.

Shut-off valve—A new shut-off valve with induction brazed joints which are capable of withstanding pressures up to 20,000 p.s.i. without leakage has been announced by Greer Hydraulics, Inc., 454 18th St., Brooklyn 15, N. Y. The valve was designed for use in systems operating pressures up to 5000 p.s.i. The poppet valve is threaded to match the valve stem whose movement is rotary. Turning the valve stem moves the poppet toward its seat which makes a perfect seal when contact is made. Flush-mated unions eliminate the need for spreading or stretching existing manifolds in order to install the valve. All working parts can be disassembled without removing the valve from the panel or manifold.

Drawing, embossing, and jacketing press—To meet the production needs of firms manufacturing cylindrical plastic containers up to 4 in. in diameter, Taber Instrument Corp., 136 Goundry St., North Tonawanda, N. Y., has announced a drawing, embossing, and jacketing press for sheet plastic. It will take sheet, roll, or die cut blanks varying from 0.005 to 0.020 in thickness. Hand feeding of circular sheets is required on the standard machine but automatic operation from roll stock can be furnished for the same press. It has a fully adjustable automatic drawing cycle with electronic timing and sensitive dual heat control. One set of drawing dies is furnished with the unit; special dies may be ordered.

Automatically aligning drill press turret—Lign-o-matic, said to be the first automatically aligning drill press turret, has been introduced by Howe & Fant, Inc., Dept. 16C, 521 Flaxhill Rd., South Norwalk, Conn. So constructed that its six spindles are automatically centered and aligned by the drill press spindle, the turret is said to have a sustained accuracy equivalent to that of the drill press to which it is attached. The six turret spindles are mounted on specially designed floating bearings so as to move laterally and angularly as well as to rotate. As the tapered driving unit attached to the drill press spindle engages the mating taper of the turret spindle, it centers and aligns it and locks it in that position until the drilling operation is completed. Driving power is transmitted from machine spindle to turret spindle by the same tapered surfaces that accomplish alignment. These tapers are ground to an accuracy of 0.00015 and will turn a ½-in. drill through hard material without a lead hole. They will disengage for indexing without stopping the motor. A new bulletin, 483, has been issued by the company describing the turret in detail.

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BOOKS AND BOOKLETS

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"Plastics Made Practical," by Chris H. Groneman.

Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Price $4.50, 324 pages.

Designed for use in schools, community and home workshops, or industrial laboratories, this book is an instructional guide for students and hobbyists interested in plastics handicraft. Working drawings, photographs, and complete tested instructions are supplied for making a variety of attractive and useful plastics articles. As a challenge to more skilled or ambitious craftsmen, a series of artist's sketches is provided. Tools and materials called for are those in common use. Information helpful in locating supplies is found in the appendix. Although emphasis has been placed on acrylics, general practical information on plastics and processing is given.

"The Heterocyclic Compounds and Organic Free Radicals," by F. Reindel and L. Anschütz. Richter's Organic Chemistry Series, Vol. IV.

Published by the Elsevier Publishing Co., Inc., 215 Fourth Ave., New York 3, N. Y. Price $12.00, 498 pages.

This new volume, translated by M. F. Darken and A. J. Mee, completes the English version of the 12th German edition of Victor von Richter's series, "The Chemistry of the Carbon Compounds." Part I of this book treats of those cyclic compounds the ring structure of which is formed of atoms of carbon and one or more other polyvalent elements. Discussion is confined for the most part to the stable heterocyclic compounds, emphasizing five- and six-membered rings. Part II deals comprehensively with organic free radicals. References to original journals, names of authors, and an exhaustive index are additions to the translation.

Withholding tax chart—Delbridge Calculating Systems, Inc., 2502-10 Sutton Ave., St. Louis 17, Mo., has brought out a revised edition of the "Delbridge Simplified Withholding Tax Chart." This easy-to-read chart gives payroll deduction figures that became effective on May 1 and also shows the special 15% deductions and daily period deductions, from one to seven days, as direct answers without the use of multiplication or division. The chart may be obtained for $3.50.

Handling of materials—"Handling Materials," a publication devoted to the science of materials handling, has assumed a new format in its initial 1948 issue. The quarterly magazine, published by Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio, is now known as "Handling Materials-Illustrated." Changes in the publication include a tabloid format which permits use of larger photographs. Copy is brief and terse, with more space being devoted to sequence photos of actual handling operations in every phase of industry.

Impregnated wood—The Bakelite Corp., 300 Madison Ave., New York 17, N. Y., has issued a 16-page booklet entitled "Densified Wood Made with Bakelite Resins," which describes how this impregnated material is produced. The properties of the wood are presented, and it is shown how established consumer products, such as cutlery, household accessories, and sporting goods, are being improved. Industrial applications are also covered.

Diamond compound—The Sapphire Products Div., Elgin National Watch Co., Aurora, Ill., has prepared a four-page circular entitled "Hyprez Diamond Compound." The circular presents an explanation of the Hyprez compound and tells where, how, and why it is used. Included are specific recommendations for the products use on carbides and steel. A price list is also presented.

Coatings for paper—A 15-page booklet entitled "Ethocel Hotmelts for Paper Coatings" has been issued by the Coatings Sec., Plastics Div., Dow Chemical Co., Midland, Mich. The booklet contains descriptions of hotmelts, how they are applied, and the properties obtained when used on papers. Included are two tables on ethocel hotmelt formulations.

Non-rotating air motors—The Bellows Co., Akron, Ohio, has published a 15-page booklet, BM-20, which describes and illustrates the various types of Bellows air motors and available accessories.

Resin plants—Blaw-Knox Co., Pittsburgh, Pa., has issued Bulletin No. 2087 entitled "Resin Plants and Equipment," a 24-page pamphlet, illustrated with pictures and charts, which describes equipment for resin plants and methods of operation.

Laboratory press—Catalog L-3C, entitled "The Carver Laboratory Press" issued by Fred Carver Inc., 345 Hudson St., New York 14, N. Y., is a 30-page pamphlet which shows the press and the standard accessories available. Also described are some of the applications for the press, together with pictures and specifications.

Dyes—Schwartz Chemical Co., Inc., 326-328 W. 70th St., New York 23, N. Y., has released a folder entitled "For Better Plastic Products," describing Rez-n-dye, a product which imparts a transparent color to almost all plastics in common use.

Continuous viscosimeter—Information covering the Fischer & Porter Viscorator is included in a new bulletin recently released by the Fischer & Porter Co., Dept. 9G-H, Hatboro, Pa. This four page bulletin describes equipment for viscosity measurements up to approximately 225 centipoises and up to as high as 800,000 centipoises.

Nylon bristles—"How You Can Save Money on the Job with Paint Brushes Bristled with Du Pont Nylon," a 14-page illustrated booklet, has been issued by the Plastics Dept., E. I. du Pont de Nemours & Co., Inc. The development of nylon bristles is traced, and the use and care of nylon-bristled brushes is discussed.

(*Please turn to next page*)

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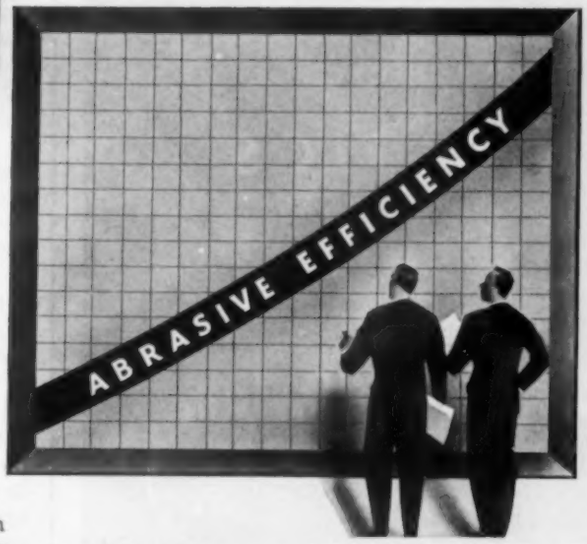

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Through a continuing program of research, The Carborundum Company is constantly developing uniform abrasive products. Products that cut faster and cooler, last longer, improve finish and in other ways add to grinding and sanding efficiency.

Accomplishments of this program are well known. To the users of abrasive products they are assurance that abrasives by CARBORUNDUM are in the forefront of technical progress. It is for this reason so many manufacturers, noted for production efficiency, prefer abrasives by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM

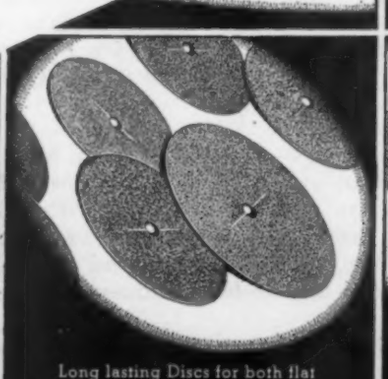
A Good Rule for Good Grinding... CALL IN

- BONDED ABRASIVES
- COATED ABRASIVES
- ABRASIVE GRAINS AND FINISHING COMPOUNDS

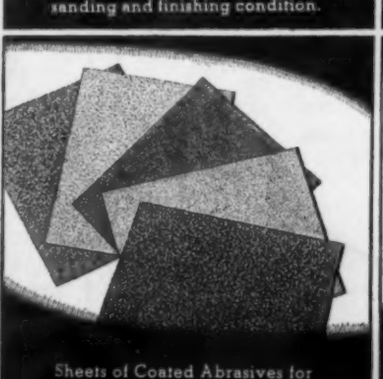
A Coated Abrasive for every sanding and finishing condition.

All standard shapes are supplied in grinding wheels by CARBORUNDUM.

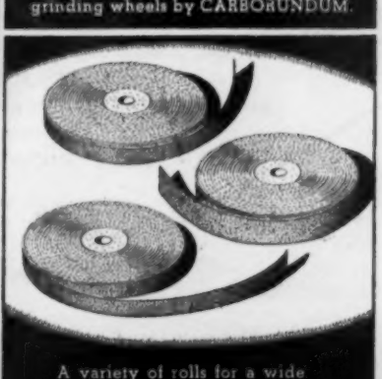
"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.



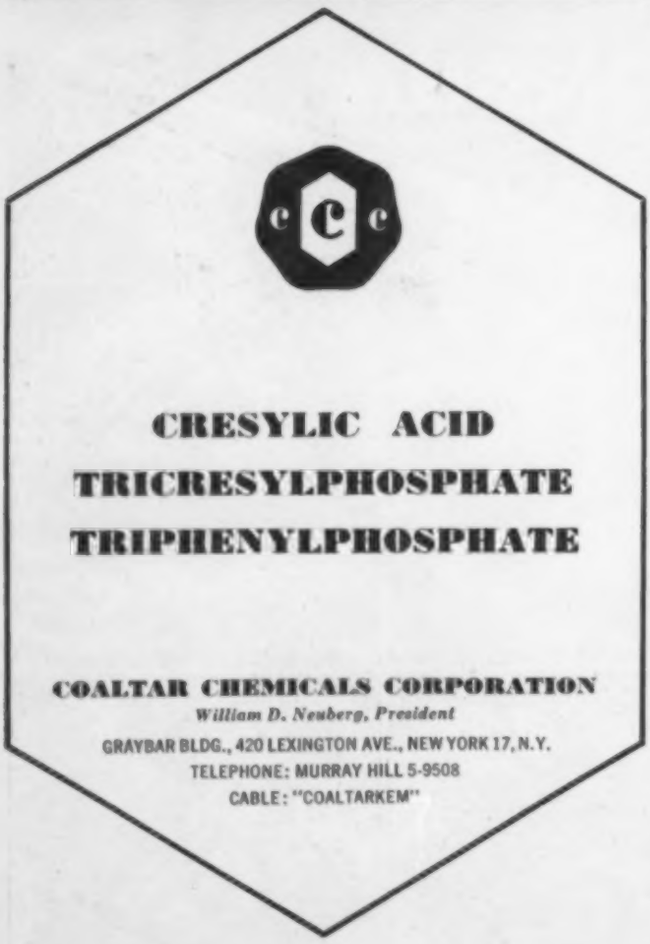
Long lasting Discs for both flat and curved surfaces.



Sheets of Coated Abrasives for a variety of applications.



A variety of rolls for a wide range of uses.



Company report—The U. S. Industrial Chemicals, Inc., 60 E. 42nd St., New York 17, N. Y., has issued a 16-page folder entitled "Products of U. S. I." The folder lists the company's complete line of chemicals, solvents, and resins with a brief description of the product accompanying each item.

Asbestos—Many of the uses of asbestos textiles in industry and in the home are dealt with in a 16-page booklet entitled "Johns-Manville Asbestos Textiles." Released by Johns-Manville Corp., Box 290, New York 16, N. Y., the booklet gives detailed descriptions of asbestos roving, lap, yarn, cloth, clothing, safety curtains, tubing, cord, wick, rope, tape, and oil burner wickings. The descriptive material on each product is accompanied by a table which gives the company's specifications for that particular product.

Cellulosic plastics—An attractive 26-page booklet, "Cellulosic Plastics, No. 4" has just been issued by the Cellulose Products Dept., Hercules Powder Co., Inc., 958 Market St., Wilmington 99, Del. The booklet explains and illustrates color grading of cellulosic plastics, properties of the cellulosics, electronic research, the John Wesley Hyatt Award, flame resistance in acetate, and new products made with cellulose acetate.

Drills—The Chicago-Latrobe Twist Drill Works, 411 West Ontario St., Chicago 10, Ill., has released a 24-page booklet entitled "Carbide Tipped Tools." The booklet lists all of the Company's different drills, reamers, etc., and presents advice on their use. Included are data on cutting speeds.

Information on nylon—"Basic Nylon Information," a 22-page booklet, has just been announced by the Nylon Div., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. The attractively illustrated booklet contains a full description of nylon's advantages for specific types of clothing and household furnishings. It also explains the physical properties on which these advantages are based, and includes sections on informative labeling and the care of nylon fabrics.

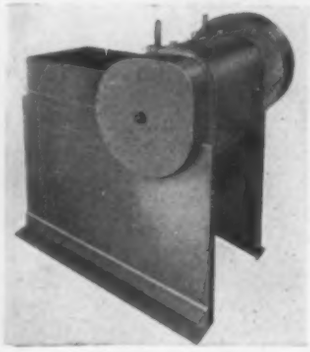
Tube fitting problems—The important role of tube fittings in the sealing of high fluid pressures is described in Catalog 400 issued by the Flodar Corp., 331 Frankfort Ave., Cleveland, Ohio. The 11-page catalog introduces in layman's language the engineering and design problems connected with the harnessing of high hydraulic pressures for trouble-free performances in hydraulic systems. Included are illustrations graphically portraying the engineering difficulties caused by tube fitting failures.

Electric counting device—Bulletin ES-91, "Counting Electrically and Photo-Electrically," has been released by the Production Instrument Co., 700-22 W. Jackson Blvd., Chicago 6, Ill. This 16-page bulletin deals with electric counter applications for counting parts, cartons, cases, boxes, mechanical operations, oranges, towels, folding machine production, etc. Illustrations show both photoelectric actuation and operation with specially designed switches.

Data on taxes—"Taxes and Profit Sharing Plans," a 16-page booklet published by Charles D. Spencer & Associates, Inc., 166 W. Jackson Blvd., Chicago 4, Ill., explains the U. S. Treasury approved plan for profit sharing under which employers and employees are accorded favorable income tax treatment.

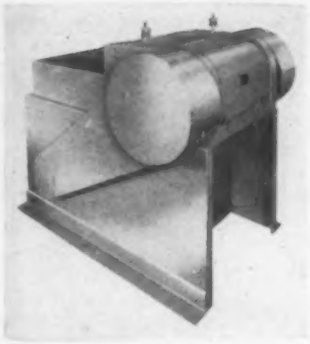
Cumberland Machines for the Plastics Industry

New!



CUMBERLAND ROTARY CHOPPING MACHINE

This machine cuts slab material from compounding mills, chops continuously extruded rods, sheets or strands, and cuts up calender roll side shear strips. This machine is also used in conjunction with extrusion machines to produce cube or pellet material suitable for a molding compound.

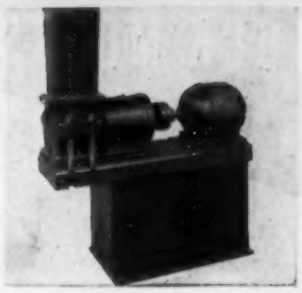


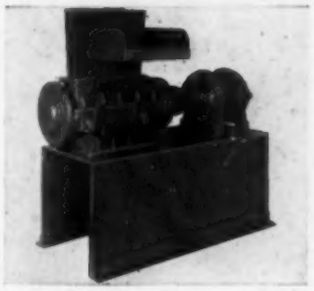
CUMBERLAND SLITTING & MANGLING MACHINE

This machine is useful primarily to manufacturers who compound plastic materials. The machine may be used to reduce material for use as a commercial product without further granulating. Or it may be used to prepare material for subsequent final reduction in a granulating machine.

CUMBERLAND PLASTICS GRANULATING MACHINES

These machines are designed especially for plastics. They perform with high efficiency the special cutting requirements of plastic materials. They are simple in design, rugged in construction and are easy to dismantle and clean. These machines are built in two styles. Nos. 0, ½ and 1½ as at top right (No. ½ is illustrated). Also, large 18" machine, double hung, with retractable knife block for complete accessibility. (Illustrated at right below.)





REQUEST CATALOGS

Plastics Granulating Machines.....No. 200
Slitting and Mangling Machine.....No. 300
Rotary Chopping Machine.....No. 400

CUMBERLAND ENGINEERING COMPANY, INC.

Dept. (A), Box 216, Providence, Rhode Island

WE BUY IT...
SELL IT...
RE-WORK IT

PLASTIC SCRAP

Plastics Division:

H. MUEHLSTEIN & CO. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis

WAREHOUSES: Jersey City • Akron • Boston • Los Angeles • Memphis

PLASTICS STOCK MOLDS*

JUNE 1948

A—Steering wheel for toy autos, etc., 8-in. diameter, weight 1 lb. 2 oz. Molded with steel insert for securing wheel to the steering shaft. Molded from thermosetting materials in a two-cavity mold. Any standard color.

B and C—Game arrow sets. Length of B is 6¾ in.; width is ¾ in. at its widest point. Length of C is 7⅞ in.; width is 1 in. at its widest point. The spinner pin is part of the set and designed so that arrow can be secured to a game board with the screw in the cavity in the underside of the pin. Thermoplastic. Molded in four-cavity mold. Any standard colors.

A to C inclusive manufactured by Junior-Pro Products Co., 3206 Morganford Rd., St. Louis 16, Mo.

D—Poker chips, 1½ in. diameter, approximately 10 lb. per 1000. Phenolic or urea. Assorted colors.

E—45 ligne buttons, approximately 1 lb. per gross. Phenolic or urea. Assorted colors.

F—Compact, 3¼-in. diameter, approximately 85 lb. per 1000. Phenolic or urea. Assorted colors.

D to F inclusive manufactured by Quality Plastic Co., Inc., 119 E. 22nd St., Brooklyn 26, N. Y.

*Reg. U. S. Patent Office.

HERE'S THE ANATOMY OF

A BETTER WAY TO MIX PLASTICS

Sides and rotors cored for circulation of cooling water or steam.
Power-operated sliding discharge door also cored for steam or water circulation.

This drawing of the "insides" of [illegible] the design elements that assure maximum thoroughness and uniformity in mixing plastics stock under close temperature control.

Essentially, the machine consists of a completely enclosed mixing chamber in which two spiral shaped rotors operate, a hopper to receive the material for mixing, and a sliding door for discharging the batch.

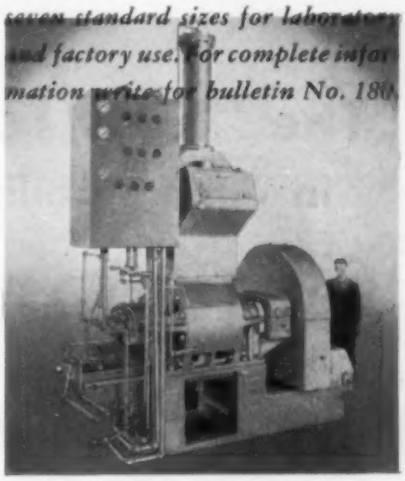
Revolving in opposite directions and at different speeds, the two rotors keep the stock in constant circulation. The ridge between the two cylindrical chamber sections helps force intermixing, and the acute convergence of the rotors with the chamber walls imparts a smearing action. This combination of intensive working produces a highly homogeneous mix.

Throughout the mixing process, you can keep the batch temperature under close control. Valves and gauges for the various temperature-regulating circuits shown in the drawing are mounted on a panel at the operating platform. By manipulating them it is a simple matter to bring the batch temperature to the desired point and keep it there. An electrically actuated potentiometer pyrometer with its thermocouple in direct contact with the batch, indicates and records the temperature on a chart.

An automatic timing device is also included on all production size Banburys.

•

Banbury Mixers are built in seven standard sizes for laboratory and factory use. For complete information write for bulletin No. 180.



F-B
PRODUCTION UNITS

- Banbury Mixers
- Plasticators
- Pelletizers
- Mixing, Grinding, Warming and Sheeting Mills
- Bale Cutters
- Tubing Machines
- Refiners
- Crackers
- Washers
- Calenders
- Hose Machines
- Hydraulic Presses and other rubber working equipment.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Chicago, Los Angeles, Tulsa, Houston.

FB-284A

Farrel-Birmingham

BETTER
Flexible
METAL HOSE
FOR EVERY PURPOSE
• SEAMLESS—Constructed from one continuous piece of uniform thickness • PARALLEL CORRUGATION assures maximum strength and flexibility • SPECIAL ALLOYS can provide either heat or acid resistance • AVAILABLE in wide variety of types to convey all kinds of liquids and gases • AVAILABLE in special assemblies to meet your special requirements.
White Eclipse-Pioneer for information.
ECLIPSE-PIONEER Division of
TETERBORO, NEW JERSEY
Bendix
AVIATION CORPORATION

The "New Look"
in Vinyl Stabilizers

Stabelan XL

STABELAN XL is based on an entirely NEW PRINCIPLE of stabilization directed towards *improving the resins themselves.* Correctness of the principle involved is fully verified by excellent results obtained in Florida exposure tests, proving that the use of Stabelan may double or even treble the life of vinyl resin films.

Why not take a "New Look" into this whole subject? For samples and technical information, address

STABELAN CHEMICAL CO.

P.O. Box 665 **Toledo 1, Ohio**

Consumption of

MARCH consumption figures broke a number of records. The total monthly figure was the largest ever recorded; polystyrene, phenolic molding materials, and vinyls registered the greatest consumption figure in their history. In one category, molded and extruded materials, vinyls fell off 800,000 lb., but this may be due to an adjustment of figures since some companies are reported to have been including fillers and plasticizers in previous

PLASTICS AND SYNTHETIC RESIN CONSUMPTION
From Statistics Compiled by Bureau of

Materials	
Cellulose acetate and mixed ester plastics[a]	
Sheets	
Continuous (under 0.003 gage)	
Continuous (0.003 gage and upward)	
All other sheets, rods, and tubes	
Molding and extrusion materials	
Total	
Nitrocellulose plastics[a]	
Sheets	
Rods and tubes	
Total	
Other cellulose plastics[a, b]	
Phenolic and other tar acid resins	
Laminating (dry basis)	
Adhesives (dry basis)	
Molding materials[c]	
All other, including casting (dry basis)[b]	
Total	
Urea and melamine resins	
Adhesives (dry basis)	
Textile and paper treating (dry basis)	
All other, including laminating (dry basis) [b, c]	
Total	
Polystyrene[b, d]	
Vinyl resins	
Sheeting and film including safety glass sheeting[e]	
Textile and paper coating resins (resin content)	
Molding and extrusion materials (resin content)	
All other including adhesives (resin content)[b]	
Total	
Miscellaneous resins	
Molding materials[a, c]	
All other (dry basis)[b, f]	
Total	
Grand Total	

[a] Includes fillers, plasticizers, and extenders. [b] Excludes data for protective coating resins. [c] Excludes urea and melamine molding materials; see footnote[e]. [d] Dry basis, including necessary coloring material. [e] Includes data for urea

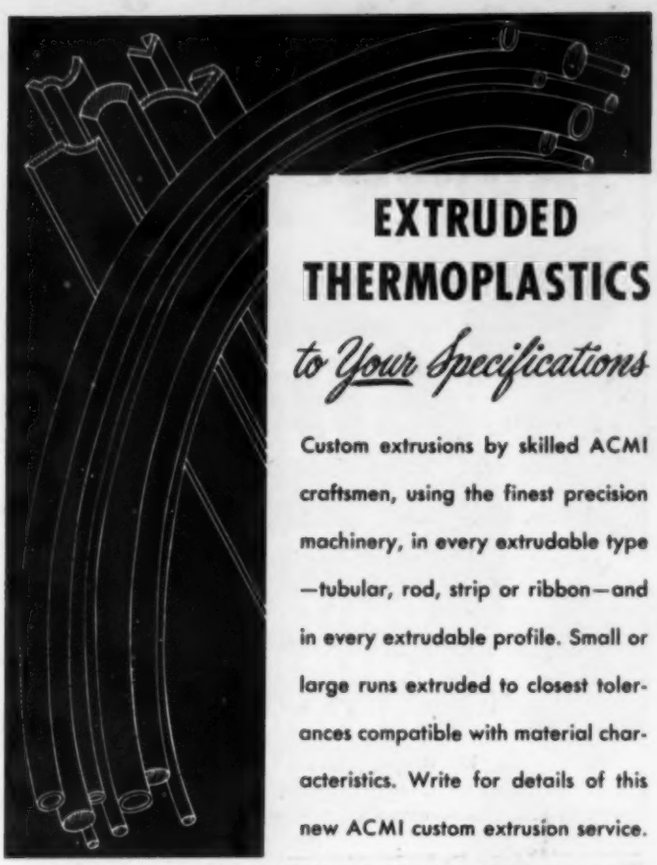
Plastics Materials

reports rather than solid resin content only. The polystyrene upsurge was thought to be due to increased industrial applications and the fact that March is always a big volume month in the toy market. The sizable ethyl cellulose figure is a hint as to what is happening in the toilet seat market. All indications are that March was an unusual month—considerably better than may be expected for April and May.

IN POUNDS FOR FEB. AND MARCH 1948
Census, Industry Division, Chemical Unit

February 1948	*March 1948*	*Total for first three months—1948*
lb.	*lb.*	*lb.*
486,811	483,118	1,335,913
534,599	633,821	1,823,270
299,727	236,607	801,184
3,733,443	3,960,291	12,154,642
5,154,580	5,313,837	16,214,521
658,059	736,448	1,977,101
271,822	262,722	817,339
929,881	999,160	2,794,430
651,637	768,754	2,167,207
3,159,761	3,611,012	10,160,310
1,790,826	1,928,026	5,456,593
17,370,124	19,715,665	55,423,878
4,379,839	5,339,198	15,002,832
26,701,550	30,593,901	86,044,613
4,183,184[r]	5,200,142	13,980,300
1,737,401[r]	1,211,908	4,630,491
851,538[r]	694,366	2,101,420
6,772,123	7,116,416	20,712,211
8,382,160	12,717,696	31,326,075
5,980,191	7,537,151	21,301,869
2,102,156	3,053,490	7,570,084
7,601,313	6,767,151	22,191,773
1,950,604	1,679,557	5,161,631
17,634,264	19,037,349	56,225,357
4,768,946	5,397,517	15,126,047
3,030,655[r]	3,241,796	8,989,562
7,799,601[r]	8,639,313	24,115,609
74,025,496[r]	85,186,426	239,600,023

and melamine, acrylic acid, and miscellaneous molding materials. [f] Includes data for petroleum resins, acrylic acid ester resins, mixtures, and miscellaneous synthetic materials. [r] Revised.



EXTRUDED THERMOPLASTICS
to Your Specifications

Custom extrusions by skilled ACMI craftsmen, using the finest precision machinery, in every extrudable type—tubular, rod, strip or ribbon—and in every extrudable profile. Small or large runs extruded to closest tolerances compatible with material characteristics. Write for details of this new ACMI custom extrusion service.

AMERICAN CYSTOSCOPE MAKERS, INC.
1241 LAFAYETTE AVENUE • • NEW YORK 59, N. Y.

Don't *GUESS* at Mold Temperature

Improper molding temperature of plastics is a common cause of off colors, brittleness, soft centers and low tensile strength. The routine use of the Cambridge Mold Pyrometer will go a long way in avoiding the spoilage caused by off-temperature molds. It is an accurate, rugged instrument that instantly indicates the surface temperature of mold cavities so that the operator can control it.

Send for Bulletin 1945

Cambridge Instrument Co., Inc.
3711 Grand Central Terminal, New York 17, N.Y.

Combination and single purpose instruments

CAMBRIDGE
Roll ★ Needle ★ Mold
PYROMETERS

Bulletin 194-S gives details of these instruments. They help save money and make better plastics.

Works Manager for Plastic Toys

Nationally-known, AAA1 Manufacturer of plastic and metal toys seeks top-grade works manager. Must have plastics experience. Extraordinary opportunity and fine future for energetic, aggressive, capable man. Write in strict confidence — all details, background, business history and expected salary.

Reply Box No. D667.

MODERN PLASTICS, INC.

122 E. 42nd St., N. Y. 17, N. Y.

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL* (BENZOYL PEROXIDE) LUPERCO* (PEROXIDE COMPOUNDS)

ALPEROX* C (TECHNICAL LAUROYL PEROXIDE)

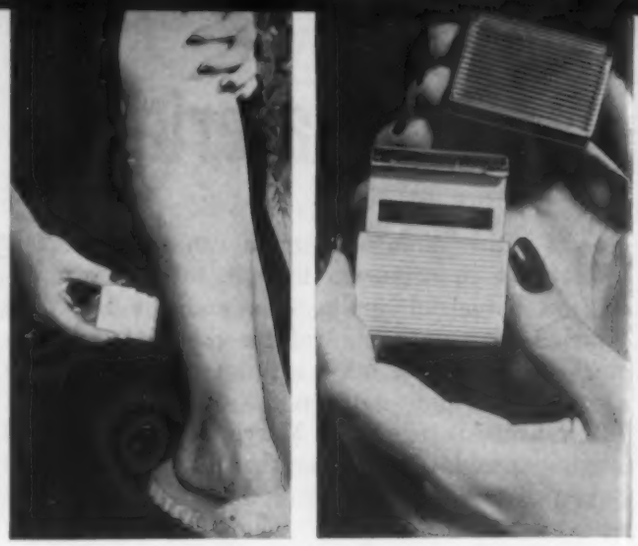
LUPEROX* (PEROXIDE PASTES) LUPERSOL* (PEROXIDE SOLUTIONS)

Special Organic Peroxides

* REGISTERED TRADEMARK

TRADE MARK

LUCIDOL DIVISION
NOVADEL-AGENE CORPORATION
BUFFALO 5, NEW YORK



Razor designed specially for women has two-part body of cellulose acetate butyrate, and gold-colored metal cap

Boudoir Razor

A WOMEN'S [illegible] designed as to be a worthwhile addition to the dressing table —has recently been developed and introduced by Eversharp, Inc., manufacturer of the Schick-Injector razor. The new product, made of cellulose acetate butyrate, is molded in two parts by Amos Molded Plastics, Edinburg, Ind.

Plastic and metal combined

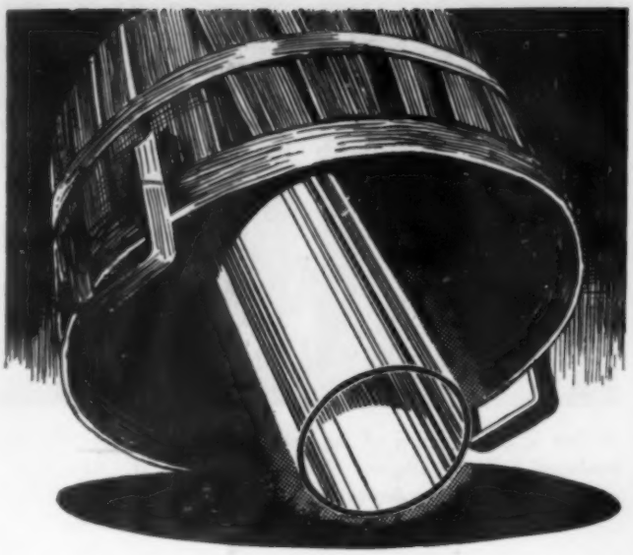
The Fashion Razor, as it is called, appears at first glance to be a compact or a flacon of perfume. It has a white, fluted base of plastic, and a gold-toned metal top, a combination so attractive that the razor may be considered in the gift possibility category. A gold and white box for the razor carries the color theme to the outside package.

Standing approximately 2½ in. high and 1½ in. wide, the Fashion Razor is extremely easy for a woman to use. The long, narrow handle of the conventional man's razor is replaced in the Fashion Razor by a fluted base.

Blade changing

Eversharp has incorporated the familiar "push-pull, click-click" blade-changing principle in the lady's razor, just as it did in its masculine counterpart. There are no packages to unwrap, and no blades to handle. A simple flip of the fingers will reject the old blade and insert the new. Blades from the man's razor are interchangeable.

The head of the razor is slanted at such an angle as to insure swift, sure use. A small, stiff brush, to be used to whisk away stray hairs in the razor, is included in the box.



Have we been Hiding our Light* Under a Bushel?

***LARGE DIAMETER TUBING**

● Judging by recent inquiries received, many manufacturers, seeking elsewhere in vain, apparently do not know that large diameter thermoplastic tubing is being produced.

Well, it's true, and for over a year Carter has been producing such tubing in diameters up to 10″ and larger, in all thermoplastics, held to the same close tolerances for which Carter smaller plastic tubing has been famous.

If you have an application for tubing—rigid or elastomeric—square, oval, hexagonal—in acetate, butyrate, ethyl cellulose, vinyl or polyethylene—write to Carter and we will show you how to save countless dollars in fabrication.

And don't limit your inquiries to large tubing alone. Carter close tolerance tubing of all diameters and shapes has helped manufacturers of vacuum cleaners, toys, automobiles, busses and technical products of all kinds to save money where high quality and precision are required. Carter, one of the oldest names in plastic extrusion stands ready to serve you in tubing or extruded sections of all types.

You may be interested in the fact that Carter is also a large producer of polyethylene film in tube or sheet stock held to the same close tolerance. Write us for details.

CARTER
PRODUCTS CORPORATION

Manufacturers of Extruded Plastics

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New Cold-Mold Plastic Powder

GLADITE revolutionizes the cold-molding plastic field. Requiring no pre-heating, no pre-forming, no after baking, no tumbling, your product comes out of the press *finished* . . . needs no buffing, grinding, or polishing. You save man hours and cut production costs.

Production up to 30,000 small units per press per hour is possible. GLADITE is adaptable to rotary, single-stroke or hydraulic presses.

GLADITE comes in a variety of colors. Can be provided with special dielectric properties for electrical insulating uses; formulated to withstand temperatures up to 700° F. Finished products are resistant to oil, alcohol and other organic solvents.

GLADITE overcomes almost all previous disadvantages of cold-molding plastic powders. Physical properties can be varied by formula to adapt it to many uses.

Write for free sample canister and try it on your presses. Our engineers are at your service.

Property	GLADITE
Flow	Free Flowing
Bulk Factor	2 to 1
Colors	Black to light pastel
Uniformity of Colors	Good
Dielectric Strength	Good
Arc Resistance	480 seconds (no failure)
Molding Pressure	12 to 15 ton / in.^{2}
Rockwell Hardness	H72
Solubility:	
Alcohol	Slightly to insoluble
Organic Solvents	Insoluble
Grease	Insoluble
Oil	Insoluble
Compression Strength	10,000# / in.^{2}
Impact Strength	1.93 ave. IZOD
Dimensional Stability	Excellent

MYLER
PLASTICS CORP.
COLD-MOLD PLASTIC POWDERS
92 BISHOP ST. • JERSEY CITY 4, N. J.

GLADITE

It's high time we met!

Fabricators are fast discovering the outstanding virtues of wondrous RUCOAM film. Formulations are specially developed for new colors ...extra stability...smoothness of texture...luxurious "hand". It will not craze, crack, scuff, mildew, fade. Tests show its superior resistance to streaks, abrasions, acids, alkalies, alcohol, perspiration. Meets California State Law fire safety standards...will not flash or support combustion. Just what you want for products using 3 to 22 gauge.

Many materials look alike. This label tells you it's genuine RUCOAM.

*Reg. U. S. Pat. Off.

RUBBER CORPORATION OF AMERICA 271 Ten Eyck Street, Brooklyn 6, N. Y.

At left is cross section of the cable showing oil paper insulation with polyethylene sheath surrounding it. At right is spliced cable displaying the polyethylene sheath

Polyethylene Cable

HIGH-VOLTAGE cable installation requires that a conductor be surrounded by a dielectric or non-conductor capable of resisting average heat, plus extreme heat due to an emergency load. Usually the dielectric is a chemically inert oil, which is applied as an impregnation of a cellulose paper wrapped tight around the conductor. The basic problem, however, is to enclose the conductor and its dielectric in a casing to protect it from moisture and contamination, and to maintain its mechanical and electrical integrity. A sheath of Bakelite polyethylene fills the requirements for such a compression cable as put out by the Habirshaw Div., Phelps Dodge Copper Products Corp., New York, N. Y.

Lightness in weight, impermeability to moisture, flexibility, and chemical inertness in contact with high voltage insulation are the factors that led to the use of polyethylene for this purpose.

Filled with gas or oil

The high compression cable consists of three oil-paper insulated conductors, each of oval cross section and protected by the polyethylene sheath that is metal reinforced. The installation is pulled into a steel pipe line that is laid beneath the street and is filled with gas or oil at 200 p.s.i. This high pressure, from which comes the cable's designation as a compression type, serves to squeeze the layers of paper in the dielectric area together. The polyethylene sheath distributes the pressure throughout the dielectric and allows the cable to adjust itself to the expansion and contraction of the oil.

The cable, which allows the use of high viscosity oil as the insulation and low viscosity oil as the pressure medium, is said to be capable of carrying four times its normal working voltages and to have a life of 30 to 40 years at a minimum.

Plastic MOLD DESIGNS

Injection Molders

Nylon and all Thermoplastics

Automotive Products and Novelties

SINKO

MANUFACTURING & TOOL CO.

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We offer a complete line of resin impregnated materials for all types of applications under our trade name—PHENOPREG.

Phenolic resin impregnated fabrics, papers and sheetings.

Melamine resin impregnated papers, in printed patterns, solid colors and overlay grades.

Plywood surfacing materials.

X-Crepe materials with all-directional stretch.

BCM resin impregnated fiberglas fabrics.

If you require a resin impregnated material for a molding or laminating problem investigate PHENOPREG.

VInewood 1-8200

FABRICON PRODUCTS, Inc.

Plastics Division

1721 Pleasant Avenue • River Rouge 18, Michigan

Have You Considered

Low Cost

REWORKED

Cellulose Acetate Molding Powders

✓

Bright and dark opaque colors

✓

Transparent amber, ruby, etc.

✓

Black

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We also offer other thermoplastic materials—reprocessed as well as virgin . . . If you wish to re-use your own scrap we can grind, magnetize, separate and rework it and return it to you clean and ready for use . . . On the other hand, we will buy your thermoplastic scrap, rejected molded pieces and obsolete molding powder.

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We are pioneers in the plastic trade. Our modern plant is equipped to handle your plastic mold problems. Our capable staff will engineer, design, engrave, hob and harden your molds in each of our various departments.

Your molds are tested in our injection machine before leaving our plant. This new added service now assures you of perfect pieces and immediate production.

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INCORPORATED

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Decorative Candles

A SURVEY made by Plastic Toys, Inc., Byesville, Ohio, indicated that less than 25% of all 12-in. wax candles that are purchased for decorative purposes ever have a match struck to them. With this in mind, they decided that here would be a good market for plastic candles which would be permanent and would not sag or bend when exposed to heat as ordinary wax candles too often do in hot weather.

The company originally intended to insert a string wick in the 12-in. polystyrene candle which it designed. This was to be accomplished by tying a knot in the string, pulling it through the candle and clipping it off, but the method was found impractical because of assembly problems.

Quite by accident, in wheeling the mold through the plant, the mold was dropped, causing it to warp. When the mold was placed in the machine it was found that the cavities flashed at the top of the candle. The machine was stopped and the mold returned to the machine shop. The flash was made permanent by opening the cavity, thereby molding a "wick" that both improved the appearance of the candle and eliminated a labor operation.

The candles are molded in six popular colors—white, ivory, red, blue, yellow, and pink—and are packed two dozen to the box.

Candles for decorative purposes are molded of polystyrene in six bright colors. Heat will not make them sag or bend

You can always tell THERMEX high frequency heating apparatus for plastics by the sliding drawer heating compartment. The ease, simplicity, dependability embodied by this feature is the result of experience. THERMEX pioneered in high frequency heating apparatus for plastics. THERMEX performance claims are based on successful installations. For the practical facts about what high frequency heating can do to make plastics molding more profitable, write to The Girdler Corporation, Thermex Division, Louisville 1 Kentucky.

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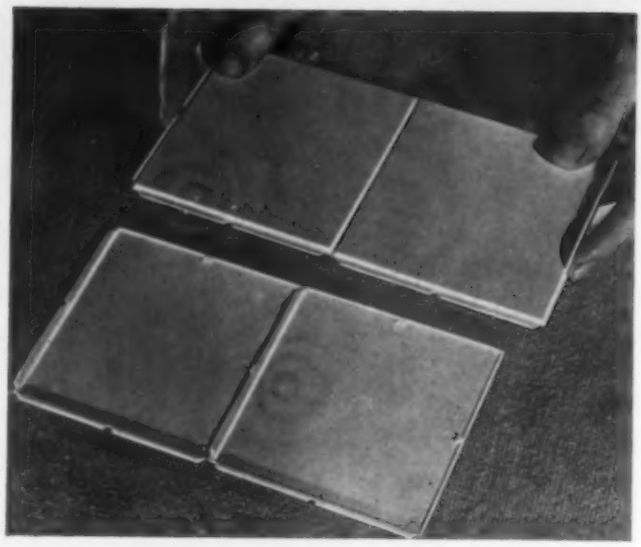

Interlocking polystyrene tiles, now available in pastel colors, are inexpensive to install and easy to keep clean

Pastel Wall Tile

POLYSTYRENE wall tile, previously available only in regular solid or marbleized colors, is now being manufactured in pastel shades. The Pittsburgh Tile Co., Pittsburgh, Pa., has introduced four pastel shades into its line of interlocking plastic tiles. The four shades are called Moonstone Blue, Seafoam Green, Peach-Glo, and Primrose Yellow. Each color is furnished with a harmonizing trim in a deeper tone.

The interlocking feature of the company's polystyrene wall tiles simplifies their installation so that highly skilled labor is not necessary. The tiles are connected by a close-fitting hinge joint which makes each tile lock into position almost automatically. Thus if the first tile is located squarely, all other tiles can be aligned correctly without difficulty.

No mortar joints needed

The hinge joints of the tiles are designed so that they overlap where they connect. Thus mortar joints between the tiles are unnecessary, and the tiles present a continuous plastic wall surface. This makes the wall easier to keep clean, because mortar joints can become dirt and dust collectors. The elimination of mortar joints also makes the tiles easier and less expensive to install because forming such joints is a time-consuming task which usually requires the services of skilled tile setters.

It is reported that these polystyrene wall tiles will not chip, rust, craze, or fade, and can be cleaned easily with a mild soap and water. The four new pastel shades have been added to a line which already includes white, ivory, black, blue, and dubonnet (all solid colors), and marbleized peach, blue, yellow, and green.

The close tolerance demanded in extruded tubing for fountain pen barrels tests the skill of any extruder. On one particular job, specifications required tubing extruded with a ±.002" tolerance. To the astonishment of the manufacturer, Anchor extruded fountain pen tubing with even *less* deviation than allowed by the exacting specifications.

Anchor Plastics' craftsmen are experts in the techniques of extrusion. Since they can do such difficult jobs so well, isn't it logical that they can also give top-grade performance on simpler extrusion assignments?

Anchor would like to demonstrate how accurately thermoplastics can be extruded. Send your next assignment to Anchor for an estimate.

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Do like he says, Mister. He's just having fun . . . one of those lucky kids with a "Magic Bullet" gun. Quite a gun, too! It's plastic . . . in bright colors. The bullet comes out the end. (Doesn't leave the gun, though.) It's got a Super Site for long-distance work. And there's a whistle in the handle.

It also has our good name behind it: The Newark Die Company.

After the "Magic Bullet" was designed by the 20th Century Products Co. (New York), The Newark Die Company took over the problems of producing the master hob, hobbed cavities, and forces.

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In our 25 years of serving the plastic industry, we've turned out thousands of compression, transfer, and injection type molds — *and to perfection.* That's why we're qualified to solve any multiple-cavity-mold problem you may have.

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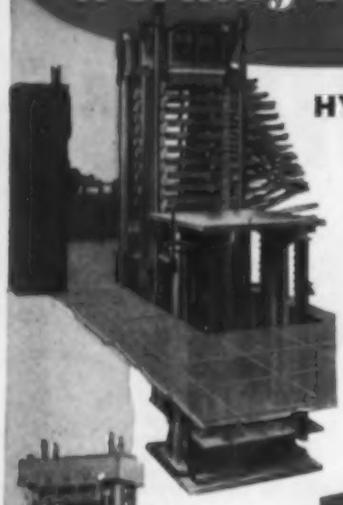

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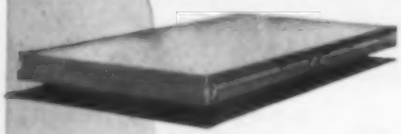

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Carbon paper made with vinyl resin back coating instead of chlorinated rubber is stronger, more resistant to wear

Better Carbon Paper

through use of vinyl back coating on tissue

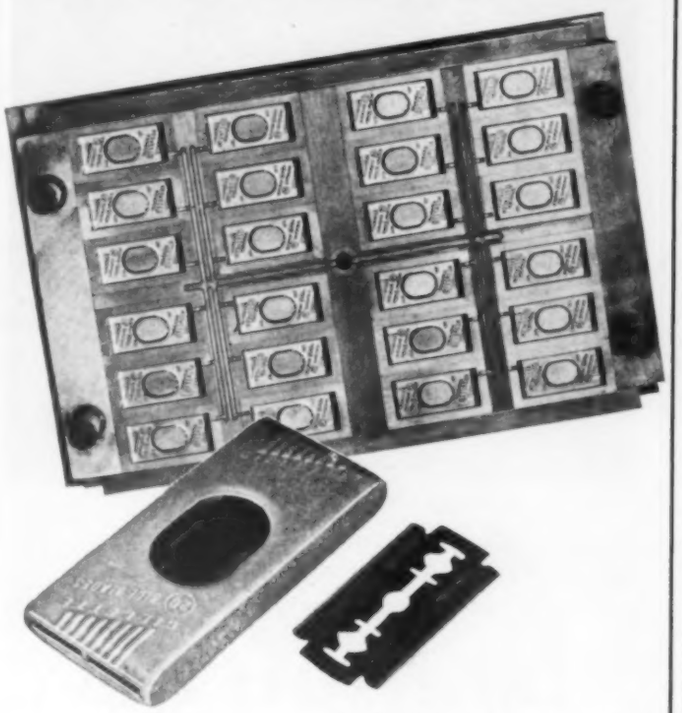
THE impact strength of carbon paper tissue has been increased approximately 30% through the use of a Vinylite resin as a back coating instead of the conventional chlorinated rubber. This new carbon paper, made by the Neidich Process Div., Underwood Corp., New York, N. Y., has shown an improvement in permanence, moisture resistance, appearance, and resistance to wear and abrasion.

It is the opinion of the manufacturers that the permanence of the vinyl as used on the carbon paper is entirely satisfactory from the standpoint of being able to keep sufficient inventory of the finished product so that they may ship their customers seasoned carbon paper. The aging of carbon paper makes it possible to obtain sharpness and maximum ink durability.

The increase in impact strength has been accomplished with a minimum coating thickness. This is a desirable improvement, particularly with the increased use of electrically operated typewriters that have a tendency to cut ordinary carbon paper. The moisture resistance of the vinyl coating plays a definite part in preventing the carbon paper from curling.

The new coating is receptive to the printing inks used to designate the various quality grades. In addition, the coating remains flexible so that as the paper is used there is still no tendency for it to curl.

BETTER MOLDING RESULTS
on this
New APPLICATION!



Molds for new razor blade dispenser engineered, built, and operated by Foster-Grant Co. for Gillette Safety Razor Co. Cavities were hobbed into Carpenter *Stainless No. 2* Mold Steel annealed to maximum Brinell Hardness of 160.

New applications and new techniques can often give you ideas that lead to better molding results. Gillette's new plastic razor blade dispenser is a good example. Produced by the millions, it called for a mold steel that could be hobbed . . . and one that would provide extra wear resistance, corrosion resistance, and minimum movement in heat treatment. Carpenter *Stainless No. 2* Mold Steel not only met this unusual combination of requirements, but also provided high strength, cleanness, and ease of ejection—*without the expense of chrome plating!*

Find how the *extra* advantages of Carpenter *Stainless No. 2* can help you improve molding and reduce unit costs, too. Your Carpenter representative has all the working information you need. Get in touch with him, today. The Carpenter Steel Company, 112 W. Bern Street, Reading, Pa.

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Water White—Full Strength—Low in Acid and Metal Content

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Mid-western paper manufacturer now producing de-inked bleached pulp on 74" wet machine in lap form, would consider proposals from reputable firms interested in resin-impregnated pulpboard. Twenty to thirty thousand pounds daily capacity.

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Due to changes in temperature and humidity, difficulty is often encountered with laminated plastics "flowing" in relay pile-ups and stepping switches. In order to overcome this instability, National research engineers have worked painstakingly to develop Grade XXX-402 Phenolite, laminated plastic, which possesses exceptionally low cold flow and remarkable dimensional stability under varying degrees of temperature and humidity.

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COURTESY TENNESSEE EASTMAN CORP.

Blowing on chimney crown model creates draft which draws smoke out of tube, thus showing how product actually works

Chimney Crown Model

SEEING is believing. With that principle in mind, The Coleman Co., Inc., Wichita, Kan., has found a way to convince a prospective buyer that the Coleman Twin-Ring Chimney Crown actually does improve chimney draft and thereby increase the efficiency of the heating system. The company's salesmen convince customers with the help of cellulose acetate demonstration models of the product.

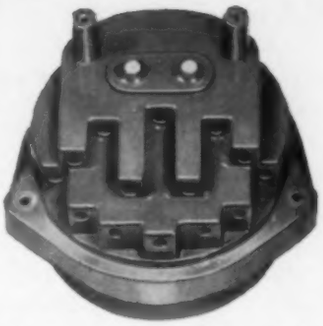
The salesman simply blows cigarette smoke into the transparent Tenite tube of the model and covers the bottom of the tube with his hand. He then blows on the crown from any angle. The effect of the air passing the twin outer bands of the crown is to draw the smoke out of the chimney.

The crown is round; therefore air from any direction produces the same results. Downdrafts produce suction since the twin bands guide the air flow across, rather than into, the vent outlets.

The model is made by Sterling Mfg. Co., Wichita, from cellulose acetate parts extruded by Anesite Co., Chicago, Ill. The crown is made of orange material, the chimney is transparent.

The plastic model is tough and light in weight; therefore it can be handled and packed safely and easily. All parts—tube, outer bands, chimney, and top disk—are continuously extruded and quickly assembled by cementing.

Mack MOLDS FOR THE LEADERS—



Distributor head molded by Mack for Scintilla Magneto Division of Bendix Aviation Corporation. A critical part of the "1710" twelve cylinder Allison engines powering the famous Mustang and P-38 fighting planes.

Write for 12 page Booklet M describing the complete Mack facilities — no obligation.

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Letting MACK figure it in plastics is good business, anytime. At MACK you receive the full benefit of experience that goes back to the early days of the plastics industry. If, on examination of your problem, we feel that the use of plastics is not the proper method, our engineers will so advise you. MACK means sound planning from choice of material and mold design to finishing. That's why a finished job from MACK will pay its way—every time!

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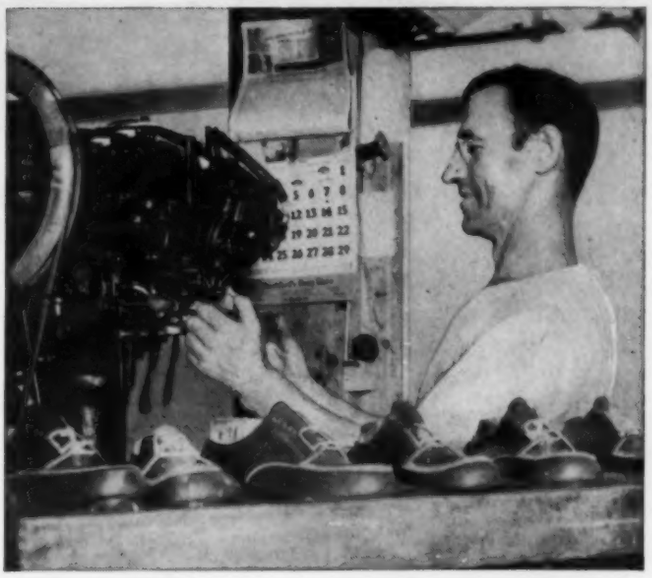
Mack MOLDED EXCELLENCE



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"Maine is known the country over as a great center for shoe manufacturing. I happen to be one of thousands of men and women who work in Maine shoe factories, and I've been working in the same factory since I finished school. I'm proud of the work I turn out, and regard my job as a profession.

"Here in Maine we workers have a double interest in our jobs, for we feel that our industry is a part of our community. We think of our work as we think of our churches, our homes, our hobbies. It is all part of the welfare of all our people. We like to take an interest in community affairs, I am president of the Shoemakers Benefit Association, and master of the Franklin Grange.

"I own my own home, planned it and built it. I'm proud of my family. My son fought in the recent war under General Patton. My daughter is married and has a family of her own. Thousands of other workers in Maine feel as I do about working and living here. We know from long experience that Maine is a great State in which to live, work, play."

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When you locate your factory in Maine, you'll find plenty of men and women like Melvin Heath in your organization. And you'll have moderately priced power; many raw materials close by; pure processing water; year-round production weather; nearness to America's greatest markets; excellent transportation; fair taxes; no State sales tax; no State income tax.

If you are planning to expand, to move, or to decentralize, it will pay you to investigate the industrial advantages of Maine. Write for free booklet, "Industrial Maine."

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British Plastics Production

THE first official figures for plastics production in Great Britain have just been released by the Board of Trade. It is reported that in 1941 the total production of all types of plastics was 16,096 tons and in 1946 this figure had risen to 34,469 tons with stocks at 1222 tons. Out of this total, 25,221 tons of phenolic and cresylic molding powders were produced as against 13,521 for 1941.

The figure for urea resins for 1946 was 6471 as against 4136 for 1941. At the present time, urea production is not sufficient to meet the demands of home resin manufacturers. In 1946, 8900 tons of urea were produced in the United Kingdom by Imperial Chemical Industries Ltd., and 800 tons imported from the Continent, making a total of 9700 tons actually consumed by industry. Methanol, from which the bulk of formaldehyde is made, jumped to 41,600 tons in 1946 as against 28,000 tons in 1941.

Turning to the thermoplastics, the only noticeable fall in output is shown by cellulose acetate sheets, rods, tubes, and films which fell from 2335 tons in 1941 to 1443 tons in 1946. On the other hand, the output of cellulose acetate molding powder increased from 1207 tons in 1941 to 4294 tons in 1946. Perspex acrylic resin sheet jumped from 1463 tons in 1941 to 3949 tons in 1946. It is noticeable that although Perspex was made to the extent of 4718 tons in 1944, only 1832 tons were manufactured in 1945. This may be ascribed to the closing down of several I. C. I. plants after the war ended when it was generally believed that the demand would show a marked decrease. Actually the reverse effect was experienced due to the great scarcity of all consumer goods and because there arose a considerable demand for fancy goods and luxury items of Perspex.

Great increase in polyvinyl chloride

Cellulose nitrate production in 1941 was 1719 tons as against 2100 tons for 1946. Polyvinyl chloride, which is as yet made only by I. C. I. Ltd., although very shortly Geon will be manufactured in Great Britain on an appreciable scale, has shown a great increase during the last five years. In 1943 only 745 tons were manufactured; today over 5000 tons are turned out. According to the official Board of Trade figures, the actual polyvinyl chloride home output for 1946 was 5471 tons with consumption at 7932 tons.

The production of plasticized polyvinyl chloride during 1946 amounted to 10,074 tons, consumption being 10,280, the small balance being imported. For the production of polyvinyl chloride, the manufacture of calcium carbide has been increased from 3100 metric tons in 1941 to 85,500 metric tons in 1946.—*John S. Trevor.*

Matched end sections, arm caps and kick plates, molded by Laminated Plastics, Inc., Cleveland, Ohio, of PARAPLEX P-43 and Fiberglas mat, made by Owen-Corning Fiberglas Corporation.

car seats get a KICK out of this . . .

. . . a million kicks, in fact, plus assorted scuffs, bumps and scratches from luggage and shoes. Car seats *do* take a beating—and that's where PARAPLEX P-43 fits in.

For beauty *with* durability, the matched end sections, arm caps and kick plates of modern car seats are made with PARAPLEX P-43 and Fiberglas. Rigid, smooth and strong, PARAPLEX laminates withstand hard usage—resist perspiration and cleaning fluids. Easily pigmented in a striking variety of colors, PARAPLEX laminates are both decorative and protective. And because the parts are formed by low-pressure methods, no expensive dies are needed. The original cost is low, and model changes can be made quickly, easily, economically.

To the laminator or molder, the PARAPLEX "P" series resins offer unusual advantages. These 100% reactive polyesters cure at moderate temperatures, under contact pressure, to form clear, tough, thermoset compositions which range from extremely rigid to highly flexible, depending on the PARAPLEX grade or blend of grades which is used.

Write us today. We'll be happy to send you full details of the PARAPLEX "P" series resins—and to suggest ways in which they can improve your processing for your products.

PARAPLEX *is a trade-mark, Reg. U. S. Pat. Off.*

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HARCHEM offers you a complete line of Plasticizers for Vinyl Resins, Synthetic Rubbers and other Plastics and Elastomers. HARCHEM has developed a variety of Plasticizers, each with its own special combination of properties. This enables the user to select that particular product most suited to his own needs. Consult us if you have a Plasticizer problem. Our technical staff will be glad to assist you.

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Precision molding requires accuracy—experience—engineering—high technical skill—complete "know how" to design your piece, work out your problems, produce your piece to your complete satisfaction.

On the other hand, cookie cutting—well!

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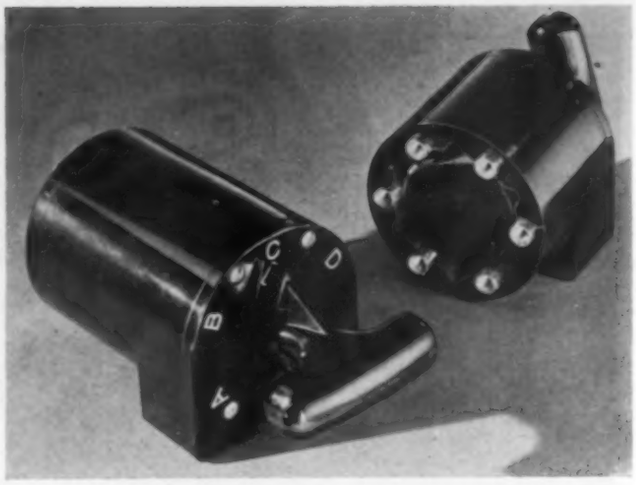

COURTESY DUREZ PLASTICS & CHEMICALS, INC.

Phenolic tap changer compensates for voltage variations in transformer by varying number of turns of wire in use

Tap Changer

AN industrial application of plastics which makes use of the high dielectric strength, mechanical strength, and impact resistance of phenolic is the transformer tap changer made by the Pittsburgh Works of the Allis-Chalmers Mfg. Co. The plastic parts are molded of Durez by International Molded Plastics, Inc., Cleveland, Ohio.

Electric power enters the normal factory at a voltage higher than that required to operate the equipment. Therefore it is passed through the primary winding of a transformer, and a current of the desired voltage is induced in the secondary coil. However, the voltage in the primary line is not constant.

The tap changer compensates for such voltage variations by varying the number of turns in use. Previously, this was done by disconnecting and switching the input lead. With the tap changer, the adjustment takes only a few minutes.

The tap changers must have high dielectric strength because of the voltages involved, and mechanical strength because of the spring loading to maintain contact between the points. It also has to operate in oil at a temperature of about 100° F. The transformer coils are submerged in oil in order to dissipate the heat generated. The tap changer contacts that oil.

Allis-Chalmers uses various sizes of tap changers for different transformer models. Taps are often arranged in increments of 2½% so that four taps allow a total variation of 10 percent. In order to make a change, it is necessary to shut down the output of the transformer for only a few moments. The input should also be shut down if it is practical to do so.

Silicone Molding Compounds

SEVEN standard grades of G-E silicone rubber molding compounds have been placed on the market by the General Electric Co.'s Chemical Dept. All grades withstand temperatures ranging from —70 to +520° F. and have excellent electrical and chemical properties. Stocks available include both molding and extruding compounds.

General Electric recommends that the molding compound be premilled for about 10 min. on cold rolls prior to molding to insure satisfactory flow and plasticity. The company says molding should be performed at low pressures in standard compression or transfer molds and that the mold design should allow for about 2 to 3% dimensional shrinkage on curing. Flash type molds give the most satisfactory results at pressures not exceeding 100 p.s.i., whereas positive or semi-positive molds are usually operated at 400 to 500 p.s.i.

The company states that molding temperature for G-E silicone rubber should be 140 to 160° C. and should be maintained for 2 to 10 min. depending on the size and cross-section of the piece.

Extruding of silicone rubber stocks is performed in either short or long barrelled production machines, but the latter is preferable, G. E. states. Accurate control of extrusion speed and die temperatures results in better surfaces and closer dimensions.

Uses for G-E silicone rubber now include gaskets for high speed shafts, Diesel, gasoline, jet and gas turbine engines, baking and drying ovens, high temperature lighting equipment, high vacuum systems, capacitor bushings, etc. The company recently announced a new silicone rubber adhesive which permits bonding of fully-cured rubber to itself and to other surfaces.

Viscoelastic Materials

(Continued from page 142)

therefore, as soon as the elongation becomes greater than that at which a given chain was formed then that chain helps to support the load. However, these new chains do not contribute very much by comparison with those chains originally present.

Working with elastomers, Andrews, Tobolsky, and Hanson (20) have also derived a theoretical equation for permanent set based on the same fundamental Equation 9. By means of this theoretical equation they were able to calculate the permanent set in advance of actually determining this property in several different elastomer stocks. According to their theory the amount of permanent set in an elastomer depends upon the elongation and the relative ratio of the number of chains of the two kinds present—those at equilibrium stretched and those at

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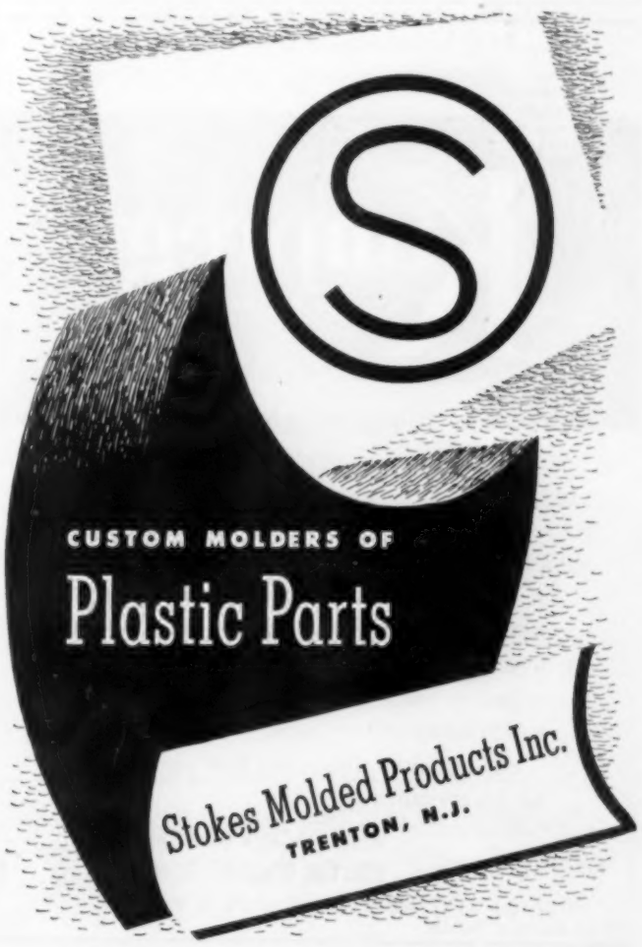

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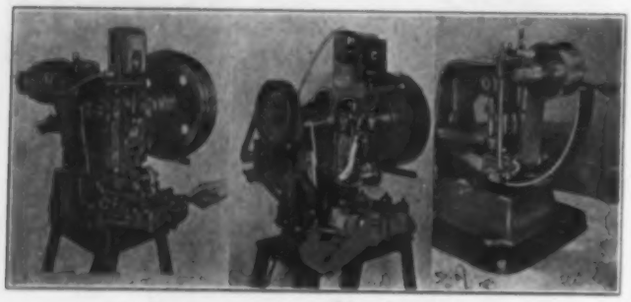

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equilibrium unstretched. When the tensile stress is released chains of the first kind try to pull the specimen back to its original shape while those of the latter kind try to hold the specimen at its deformed length. The permanent set is therefore some equilibrium point between these two extremes.

The derived equation for permanent set (20) in relation to network chains has been set up as follows:

$$\% \text{ Permanent Set} = \left\{ \left[\frac{C_1}{(S_u/S_x)C_2 + 1} + 1 \right]^{1/3} - 1 \right\} C_3 \qquad (14)$$

where s_u and s_x are the number of network chains at equilibrium at the unstretched and stretched lengths, respectively, and C_1, C_2, and C_3 are constants, the values of which are dependent on the specimen elongation. It is therefore concluded that permanent set of an elastomer depends on the elongation and the ratio of network chains s_u to s_x.

An interesting consideration of the creep and permanent set phenomena is that of a linear polymer like polyvinyl chloride. Unplasticized polyvinyl chloride is a rigid thermoplastic material which may be treated according to the conditions previously set forth. Conversion of this hard, rigid thermoplastic to a soft flexible material by means of a plasticizer allows long range elasticity to develop. It has been shown (17) that a three-dimensional gel is formed during plasticization. The resulting flexible material was found to exhibit complete creep recovery after subjection to tensile creep measurements.

Creep test techniques

The equipment necessary to carry out tensile creep tests on rigid polymeric materials is of a relatively simple nature. The following basic elements are necessary: 1) Stiff, vibration free rack from which to suspend the specimens; 2) Simple, dependable means of applying load; 3) Controlled temperature and humidity conditions; 4) Accurate means of measuring specimen elongation.

The design of the rack and load application system will depend on the material being tested. In general, the supporting racks should be so designed that premature failure of one specimen will not affect the remaining specimens. Very close control of atmospheric conditions is necessary if consistent data are to be obtained. Perhaps the most important of the above listed elements, however, is the need for an accurate means of measuring elongation.

Two classes of strain measuring apparatus are in general use. One of these is the mechanical-optical system used by Findley (2), modifications of which have been used by other investigators. The other is the bonded electric resistance gage system used by Nason, Telfair (1) and others. The mechanical-optical system is probably the more reliable of the two systems. However, great care must be taken in

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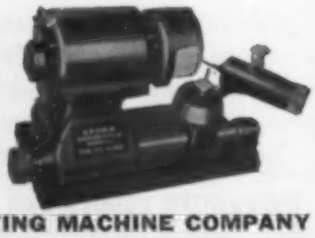

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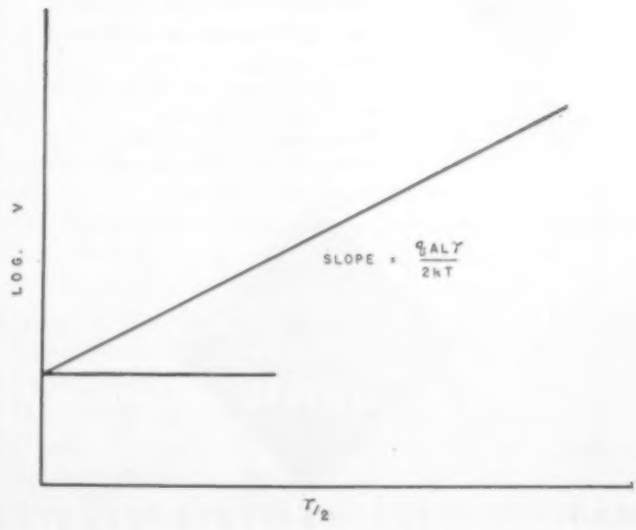
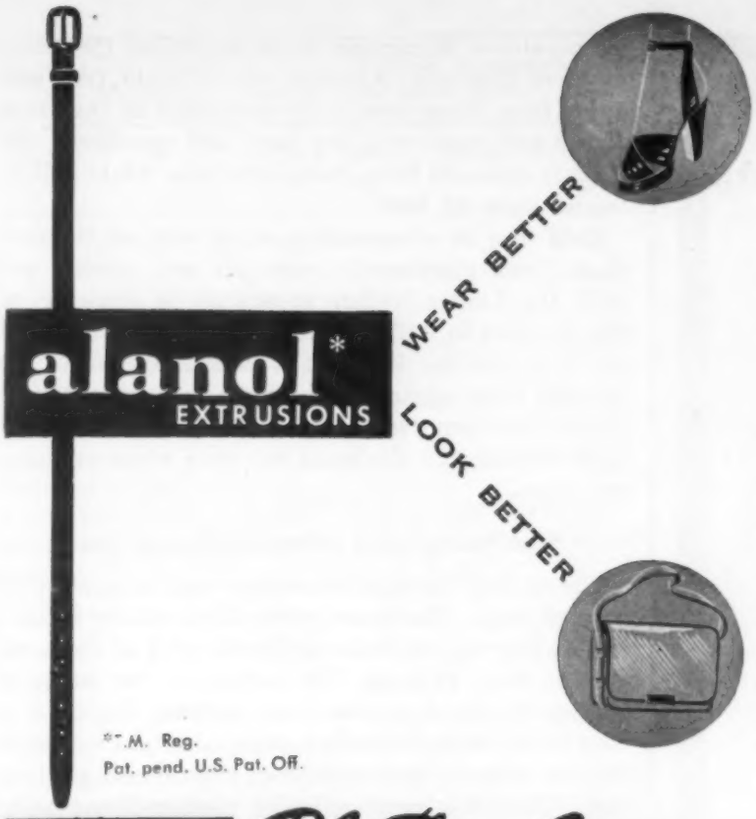
The work of the groups headed by Tobolsky at Princeton and Dillon at Firestone have contributed much to the literature on stress relaxation and creep of elastomers. The original paper by Tobolsky, Prettyman, and Dillon (16) described an apparatus which is now in operation at the Firestone Laboratories. This consists essentially of a special beam balance which operates against the stress offered by a stretched band of the vulcanized elastomer. Four of these special beam balances are mounted in an insulated glass chamber with suitable mechanism for moving the rider weights from without. The whole apparatus can be operated in any atmosphere and at any temperature chosen. A later device described by Andrews, Tobolsky, and Hanson (20) is essentially an inclined plane type of apparatus.

Creep measurements on elastomers have been made by several techniques (14, 19, 23, 25), most of them employing a tensile load, either continuous or intermittent, on a ring specimen. Permanent set measurements of elastomers have been made in various ways. ASTM methods D 412-41 and D 395-40T for tensile and compressive set respectively, have been used extensively in specification work. Other permanent set measurements at elevated

6 — Rate of creep vs shear stress (from treatment of Eq. 8)





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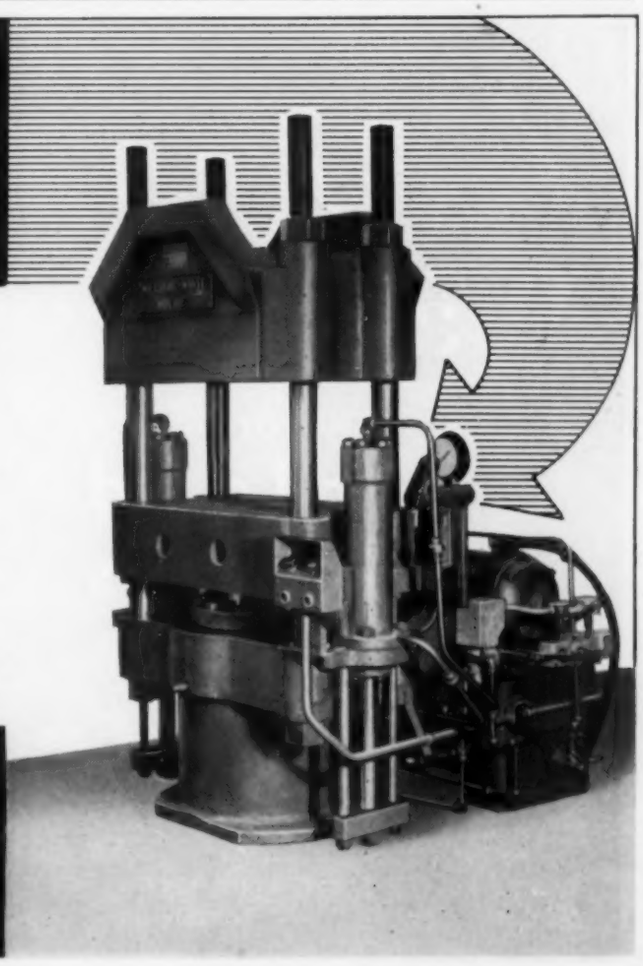

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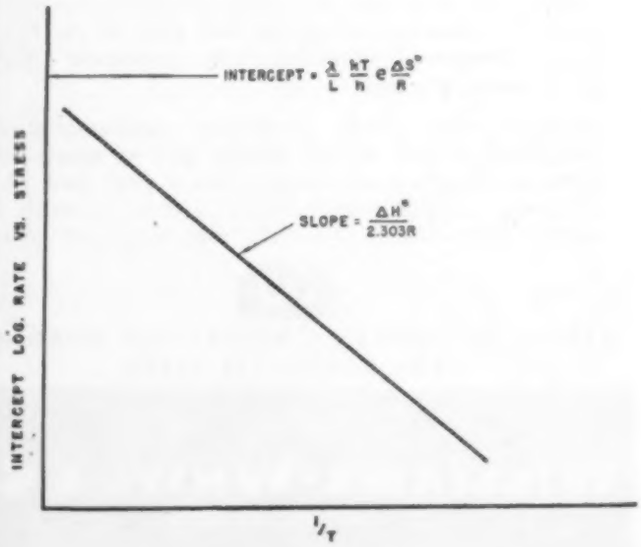
temperatures in tension have employed the technique of Tobolsky, Andrews, and Hanson (20) and differ from those previously described in that thin (0.030 in.) specimens are used and specimens are quickly released from their extension while still at temperature of test.

Cold flow or compression creep tests on thermoplastic and elastomeric materials are carried out with the Luster-Jordan apparatus. A drawing of this appears in ASTM method D 621-44T (Method A). The principle involved is essentially that of the parallel plate system whereby a test specimen is placed between two parallel plates of a constant force device and thickness vs. time measurements are taken.

Significance and interpretation of data

Creep data for rigid materials may be plotted in several ways. The basic curve from which further curves are derived is an arithmetic plot of deformation vs. time (Fig. 2). The portion of the curve to A may be divided into three regions. Region 1 is that in which elastic deformation takes place, Region 2 is the delayed deformation or high elastic portion, while Region 3 represents the viscous flow. In the discussion of basic principles, it was brought out that there are equations which apply to each type of behavior. From curves such as Fig. 2 may be obtained the total creep and creep rate at some fixed time as a function of stress, other variables being held constant. The data plotted in Fig. 2 may be plotted as deformation vs. log time in Fig. 5. This becomes a plot of the primary creep region. The change of slope (inflection point) at P may be taken as the most probable or average relaxation time for the material. The values given for elastic and delayed deformation are from Boltzmann's (19) superposition equation.



7 — Intercept of log rate of creep vs stress plotted against reciprocal of absolute temperature

Table I.—Activation Energies of Some Thermoplastic Materials (Calculated from creep data).

Polymer	*Applied load*	*Elongation*	*Temp.*	*Activation energy*
	10^7 dynes/cm²	*%*	*°C.*	*Cal.*
Polyvinyl acetate (Gelva 45)	2.5-6	373	30, 35	64,000
Methyl methacrylate	1-2	136	82, 87	122,000
Cellulose acetate	2-2.8	112	80, 86	117,000
Polyvinyl formal (Formvar 15-95)	1.6-2	137	110,115	170,000

The viscous flow region represents the type of behavior to which the activation energy equation can be applied. Thus the points on the curve of Fig. 3 could be calculated from this equation if the various parts of the equation had been previously evaluated. That is, the creep rate could be predicted over a wide range of temperature and stress values. The activation energy together with the other terms of the rate equation may be evaluated from the basic Equation 8 as follows:

1) Take the log of both sides:

$$\log v = \log \frac{2\lambda kT}{3Lh} + \frac{\Delta S^*}{R} - \frac{\Delta H^*}{RT} + \frac{9ATl}{2kT}$$

2) Plot log v vs. $\frac{T}{2}$ (Fig. 6).

3) Plot intercept of log v vs. stress against $\frac{1}{T}$ (Fig. 7).

Variation of the factor kT with temperature is negligible compared with $e^{-\frac{\Delta H}{RT}}$ in the same range. This is as far as the evaluation of terms can be carried. However, it is apparent that even this incomplete evaluation can be of considerable usefulness, for now a relationship between stress, temperature and activation energy is obtained.

The published data on creep vs. temperature for rigid polymeric materials are very meager. However, as noted earlier, Kistler (10) has calculated activation energies for several thermoplastic materials from relaxation and creep vs temperature data. A few of his values calculated from creep data appear in Table I.

Findley (3) has developed an equation for tensile creep that results in a straight line relationship on a log-log basis between deformation and stress:

$$\log (E\text{-}E_o) = N \log t + \log m \quad \text{.....(15)}$$

where E is tensile strain at time t, E_o is that value of strain required to make the equation fit the test data, N is intercept at t = 1. and m is slope of creep curve.

(*Please turn to next page*)

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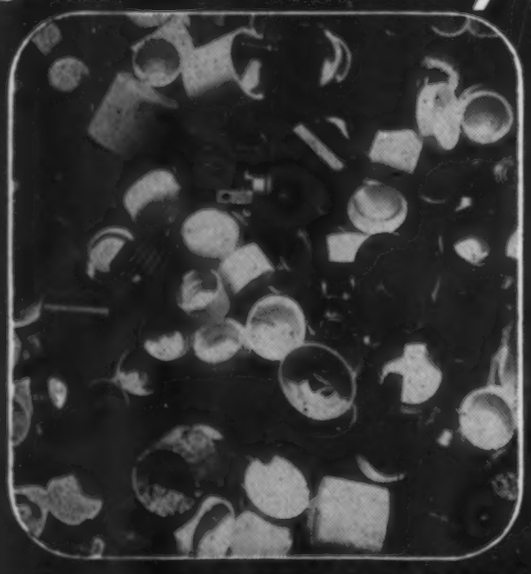

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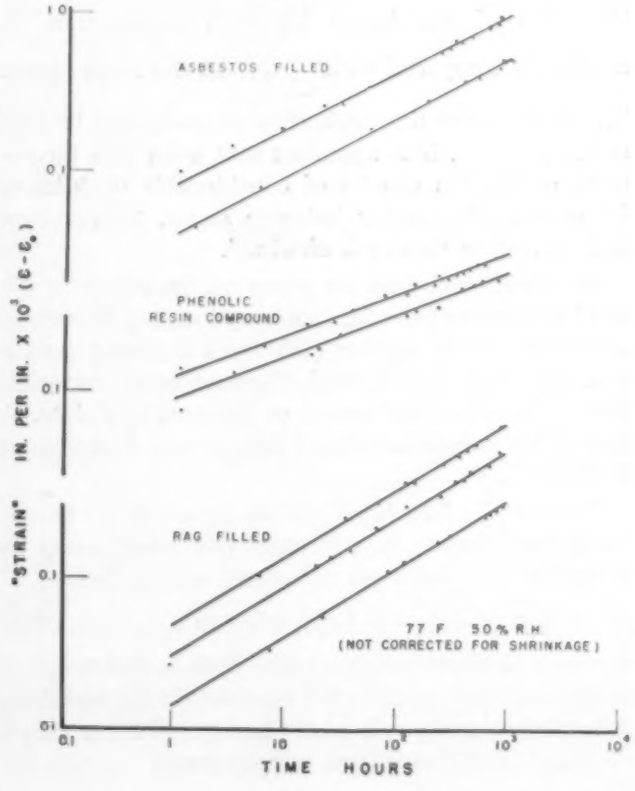
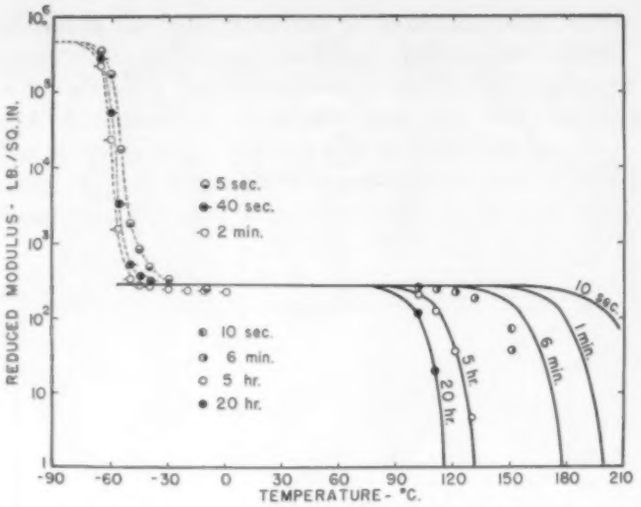
Figure 8 represents a plot of creep data for phenolic materials plotted in accordance with Findley's equation. Although this is primarily an empirical equation it does represent fairly well the creep behavior of a variety of materials. It is useful in predicting the creep properties of a plastic material from tests of relatively short duration; i.e., up to 100 or 200 hours.

Up to the present time, the majority of the creep studies on commercial thermoplastic and thermosetting materials have been conducted for the purpose of obtaining useful engineering data. The theoretical treatment of these data is difficult in that the added fillers, plasticizers, etc., preclude an accurate analytical approach to the behavior of the resin.

The superposition principle of Boltzmann which has been developed further by Tobolsky and coworkers finds good expression in the interpretation of elastomer behavior in the three temperature regions. In the high temperature region softening followed by subsequent hardening is observed with natural rubber. The rubber goes through these various stages and finally loses all its rubbery properties. GR-S on the other hand merely continues to harden. The relaxation of stress in this high temperature region is brought about by a chemical reaction which severs the chains by breaking the primary valence bonds. This, of course, is not a reversible reaction. Sufficient studies have been made to show that the presence of oxygen is required for this to occur, but the amount necessary is rather small. Surprisingly

8 — Creep of phenolic materials plotted in accordance with Findley's equation





9 — Reduced modulus vs temperature for Hevea gum stock (Ref. 14)

enough, even the traces of oxygen present in commercial nitrogen are apparently sufficient to cause stress relaxation nearly equivalent to that which would occur in air. The secondary bonds are quite unstable in the intermediate temperature region. These have all been released by the time the first stress reading can be taken and the severing of the primary bonds which is relatively fast in the high temperature region occurs so slowly that it cannot be measured in the ordinary course of experimental time. The secondary bonds, however, are quite stable in the low temperature region and relaxation of stress in this region is due to the release of these secondary bonds in the structure. These seem to be partly stable during times up to about 10 hours and do contribute to the stress. These, therefore, are reversible and it has been shown by many experiments that no permanent change is effected in the elastomer. Tobolsky has predicted (14) that if experiments could be carried out at sufficiently low temperatures, a fourth region would be found where secondary as well as primary bonds would be completely stable within experimental times and therefore there would be no change in stress as a function of time.

The differentiation between the three temperature regions is clearly shown in Fig. 9. The intermediate region of stress stability as a function of time is definite. Tobolsky and Andrews found that Hevea gum was the only rubber whose stress relaxation curve followed a simple "unimolecular" decay law of the type:

$$f = f_o e^{-k't} \qquad \text{.....(16)}$$

where k' is the rate constant of the process, f is the stress at time t, and f_o is the initial stress. This phenomenon of stress relaxation is a scission process which takes place in the presence of oxygen. It was found (14) that these relaxation rates could be re-

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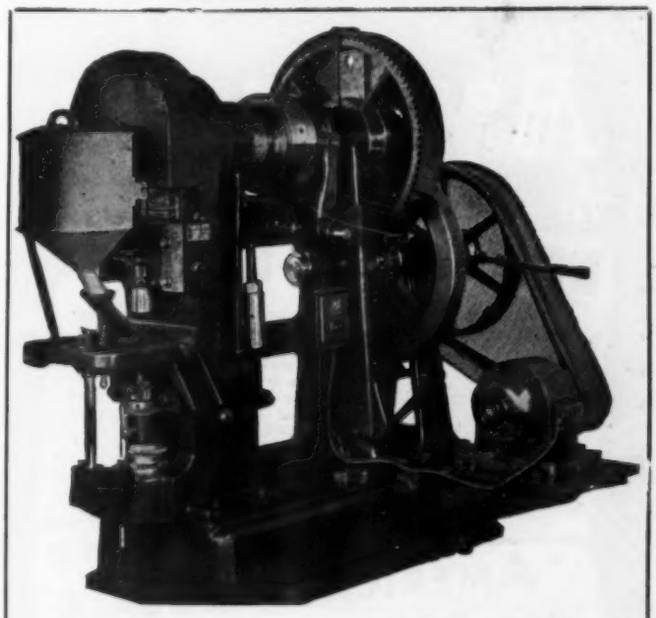

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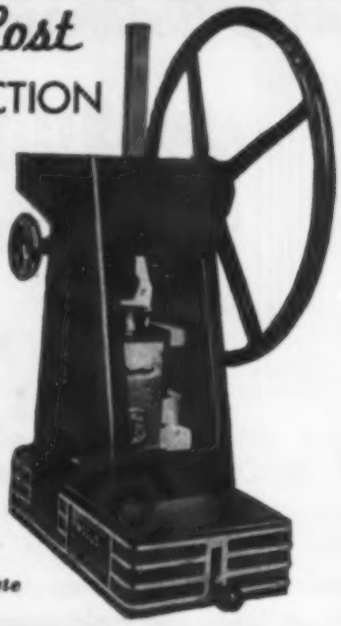

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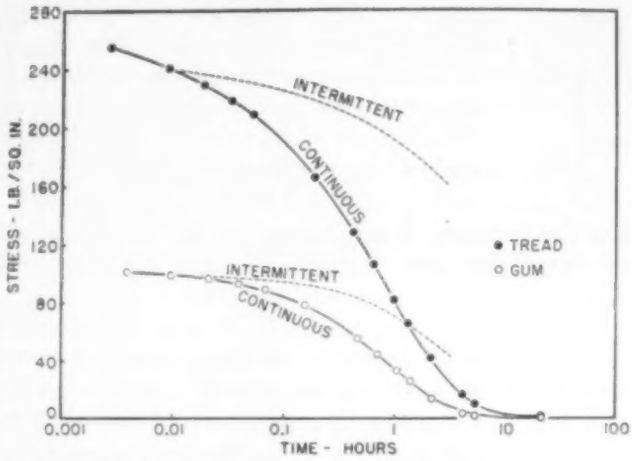
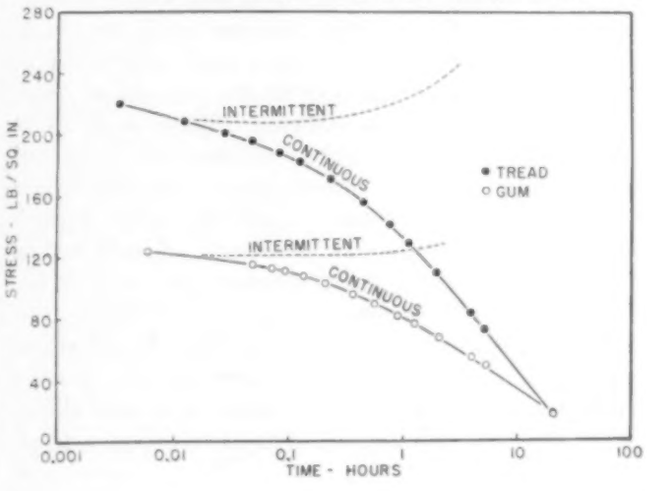
duced a thousandfold by carrying them out in highly purified nitrogen. It was also found that continuous creep at 110° C. in a vacuum of 10^{-8} mm. Hg. of a Hevea stock was also reduced a thousandfold. Apparently the effect of initial strain upon stress is not critical until elongations of 400% or greater are used. The increased relaxation rate for the increased



10 — Intermittent and continuous stress relaxation of Hevea vulcanizates; 130° C. at 50% elongation (Ref. 14)

11 — Intermittent and continuous stress relaxation of GR-S vulcanizates; 130° C. at 50% elongation (Ref. 14)



elongation may be due to stretching of the molecular chains to their maximum, thereby affecting the actual bond angles of the carbon atoms.

Comparison of continuous and intermittent stress relaxation is shown in Figs. 10 and 11 for Hevea and GR-S rubbers. In these plots comparison of the continuous with the intermittent curves indicates the latter values are greater even when the continuous curves have decayed to zero. This intermittent curve pattern may be explained by corresponding hardening or softening due to an actual measurement of the modulus and various increments of time.

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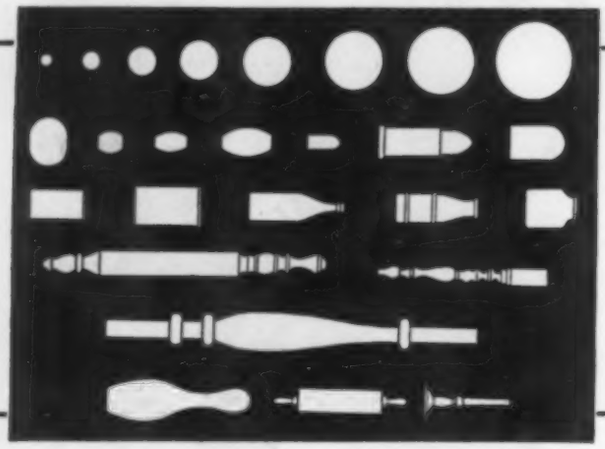

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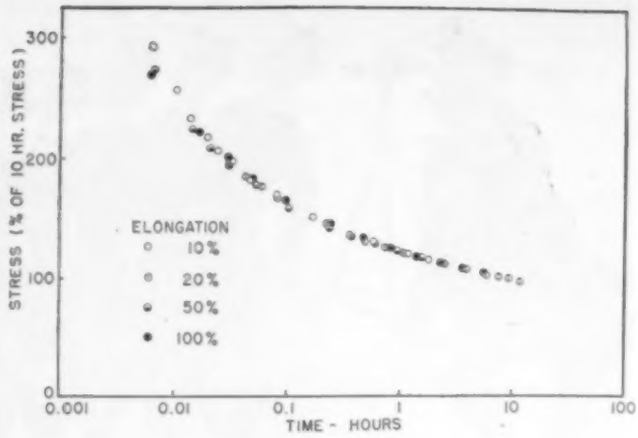


12 — Effect of elongation on stress relaxation at —50° C. of GR-S gum stock (Ref. 14)

occurring at the same time in an elastomer. One reaction is a scission of the molecular chains and the other is a crosslinking of those chains. The intermittent curve therefore measures the net effect resulting from the combination of both reactions. It is thought that these crosslinked chains are always formed in a relaxed state, thereby not adding to the stress of a sample being held at a constant strain. Therefore, the continuous relaxation curve is unaffected by this crosslinking reaction.

Observations of Tobolsky and co-workers have shown that creep and stress relaxation curves of elastomers are quite comparable at elevated temperatures. The creep of the Hevea gum stocks appears to be slightly slower than the relaxation. The creep data deviate more from the stress relaxation in GR-S than in Hevea. The deviation is also apparently greater with the tread stocks than with the gum.

The effect of different elongations on low temperature stress relaxation for a GR-S gum stock is shown in Fig. 12. The range of elongations in this plot show that the stress relaxation is independent of the elongation. Tobolsky and Andrews (14) have shown theoretically that the behavior of stress relaxation at low temperatures does not follow the decay law of Maxwell.

Practical applications

The importance of long time data on rigid high polymers lies mainly in their use in application to structural design. During the war, a rather intensive program of tensile creep studies was carried out on certain phenolics and phenolic laminates. The work on laminates was carried out to determine the suitability of these materials as components of aircraft structures.

A large amount of creep data on phenolic materials at 77° F. and 50% R.H. is now available. These data are useful to indicate the change in properties brought about by the various fillers used. Nason, Carswell, and Telfair (1) state that there is a rela-

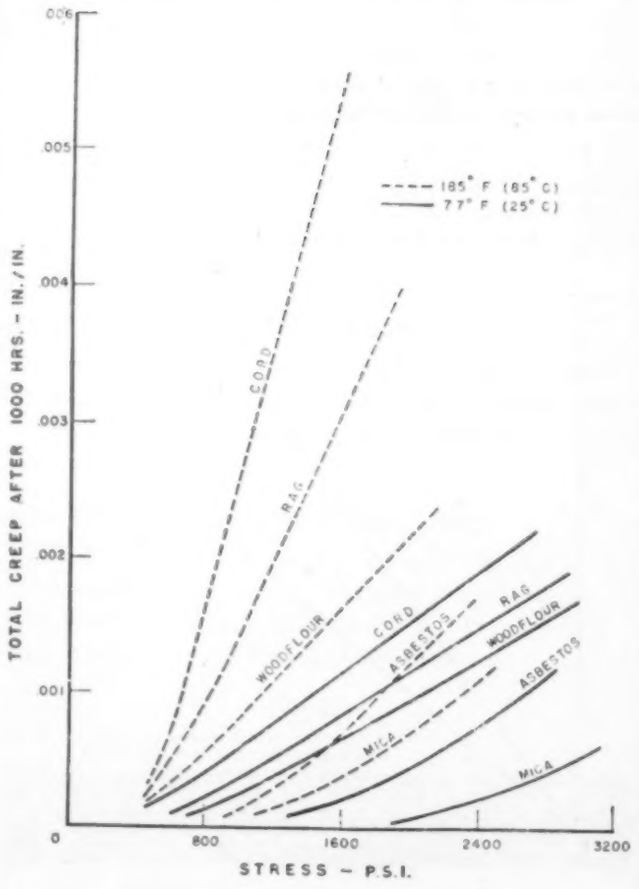
Table II.—Long Time Tensile Strength Tests at 77° F. and 50% R. H.

Material	*Estimated limiting long time tensile strength*	*Percentage of short-time strength*
	p.s.i.	
Phenolic		
Woodflour filled	2000-2500	36
Asbestos filled	1900-3000	37
Melamine		
Cellulose filled	4800-5000	67
Methyl methacrylate	3900	45
Laminate		
Phenolic, Grade XX	16,700	67

tionship between the creep rate at 500 hr. and the notch sensitivity (a function of the filler) for phenolics. Data (1) at approximately 85° C. are also available on various phenolic materials. Figure 13 compares data for three types of phenolic materials at two temperatures. Some work (22) has been done on the creep of various melamine molding compositions at 25° C. It is interesting to note from Fig. 14 that the melamine and phenolic compositions exhibit very similar creep properties where comparable fillers are concerned.

A special test which appears to be of significance from the structural viewpoint is the determination

13 — Total creep of five types of phenolic materials after 1000 hours



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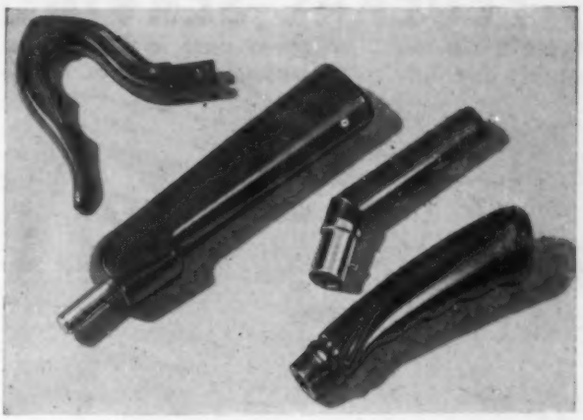

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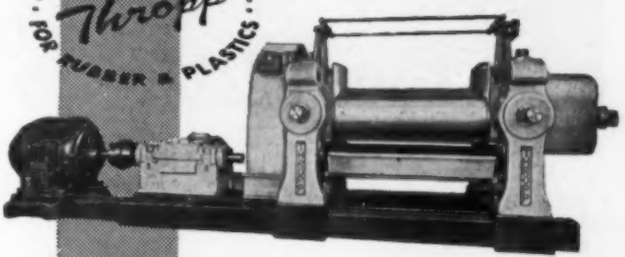

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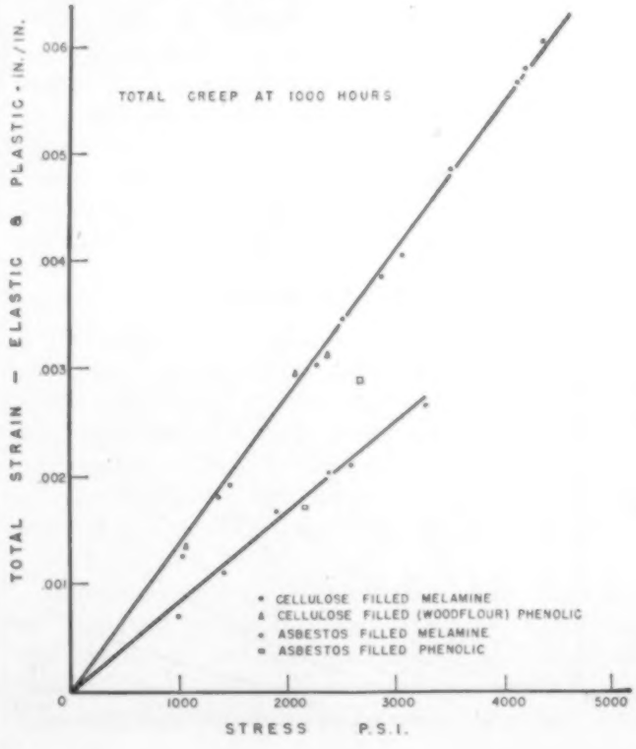
Table III.—Tensile Creep Tests at 77° F. and 50% R. H.

Material	*Total creep, amount at time*		*Creep rate, amount at time*		*Stress*
	%	*hr.*	10^{-6} *in./in per hr.*	*hr.*	*p.s.i.*
Phenolic, woodflour filled	0.27	1000	0.054	500	2000
Melamine, cellulose filled	0.27	1000	0.054	500	2000
Phenolic, asbestos filled	0.17	1000	0.03	500	2000
Melamine, asbestos filled	0.17	1000	0.03	500	2000
Phenolic canvas laminate, low pressure	0.38	800	0.04	800	2000
Phenolic rayon-cotton laminate	0.2	800	0.013	800	2000
Cellulose acetate	31.0	1000	11.25	500	2000

of the long time tensile strength for a given material. In this test, the maximum stress which a material will support for at least 1000 hr. is termed the long time strength. Table II gives some typical values.

One specific application in which the creep properties of a material are of importance is in the case of inserts in molded parts. Plastic materials have thermal coefficients of linear expansion approximately 10 times that of most metals. Consequently as the resin shrinks around the insert considerable stress is introduced into the material. This, of course, results in the insert being very firmly held in the material. An undue amount of creep (nonrecover-

14 — Creep as a function of stress of various melamine molding compositions



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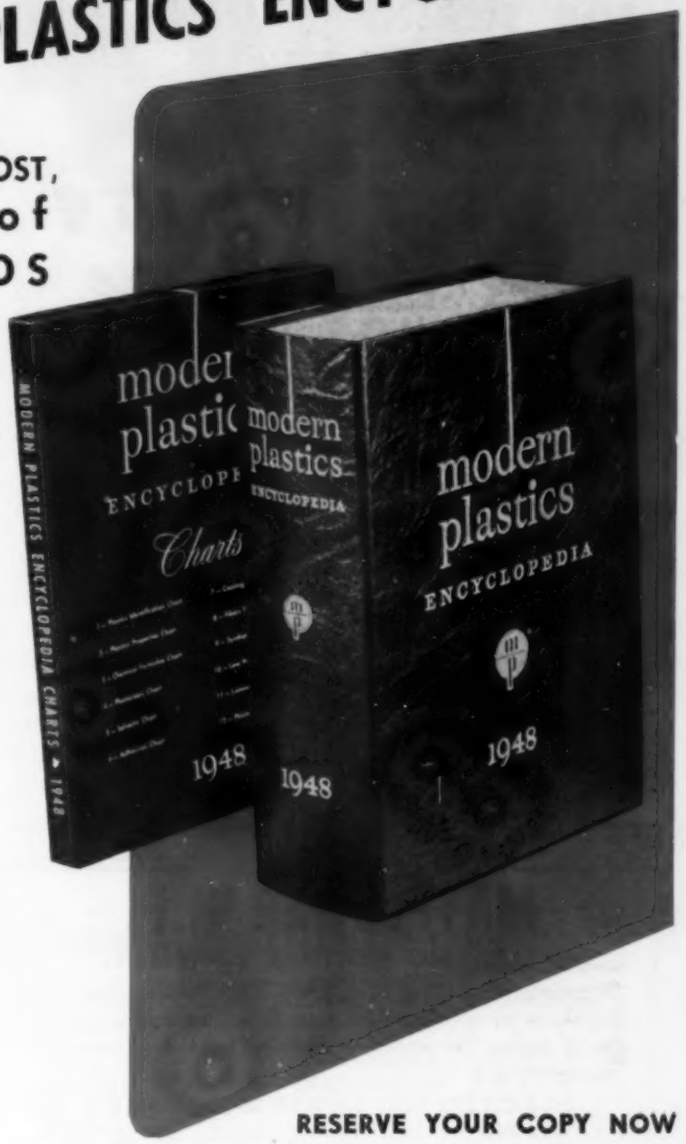

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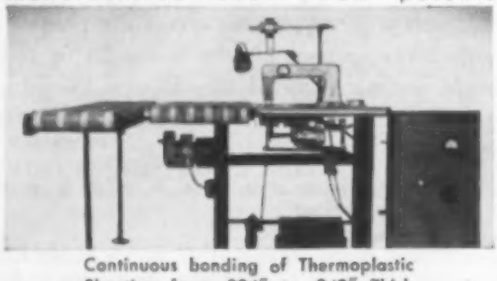

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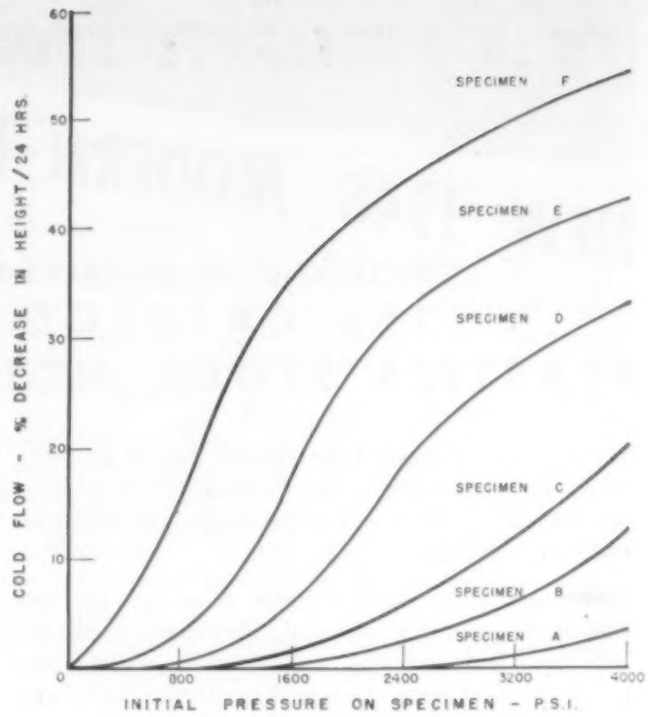


15 — Cold flow as a function of initial pressure of some typical cellulose acetate compositions

able) would eventually lead to failure of the part to perform as designed. Typical creep data are given in Table III.

"Cold flow" data are of particular importance where thermoplastic materials are concerned in structural applications. One example of such a use is a saw handle of cellulose acetate. Here, in order to obtain satisfactory performance, it is necessary to distribute the load carried by the screws over a large area of the plastic. The area is based on cold flow test data. Such design eliminates any possibility of cold flow taking place that would eventually lead to a loosening of the handle. Obviously there are many other applications where for thermoplastic materials, in particular, it is important to have a knowledge of the cold flow characteristics. Cold flow can be estimated from other types of data such as 1) Rossi-Peakes flow; 2) tensile and elongation; and 3) flexural. Fig. 15 (7) describes the cold flow behavior of some typical cellulose acetate compositions. The initial pressure on the ½ by ½-in. specimen in p.s.i. decreases rapidly above a decrease in height of 20 percent. Thus the 20% deformation should be taken as the end point of the test. Table IV (7) gives some cold flow data for various plastic materials.

Some interesting work on the cold flow properties of a number of different materials has been recently carried out by W. E. Welch. In this series of tests (Fig. 16) the temperature variable was studied. Such data are of interest in arriving at a value of the maximum continuous service temperature for a material as well as the hot forming temperature.

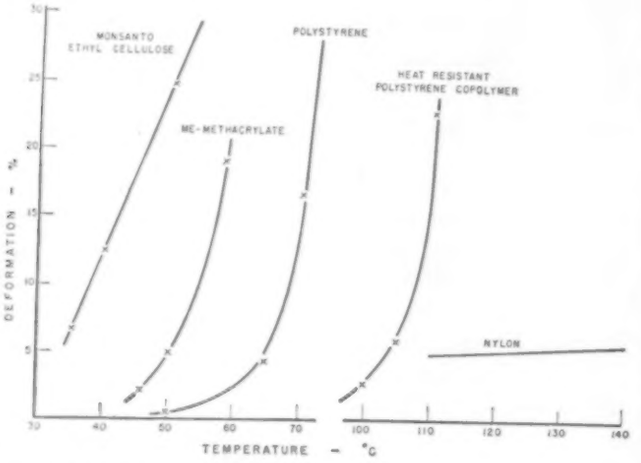
In exploratory searches for promising compounds

to be used as antioxidants in Hevea and GR-S rubbers the interrelated functions of continuous creep and stress relaxation at elevated temperature were used by one of the authors (25) as a simpler and more precise method of assessing the antioxidant effectiveness. Continuous creep data of Fig. 17 at elevated temperature were found to be a simple and significant means of determining antioxidant effectiveness in GR-S rubber. Creep measurements also indicated that the relationships between the effectiveness of various antioxidants in Hevea rubber were independent of both accelerator and state of cure.

Future developments

Much experimental work remains to be done to test completely the theoretical nature of stress relaxation and creep. This is true for the entire field of high polymers, from the rigid to the elastomeric or non-rigid materials. An interesting critical analysis in this direction already has been made by Mooney and co-workers (11) for elastomers.

Following up the theoretical studies it seems de-



16 — Cold flow as a function of temperature of typical polymers

17 — Continuous creep of GR-S tread stocks; 30 p.s.i. stress in air

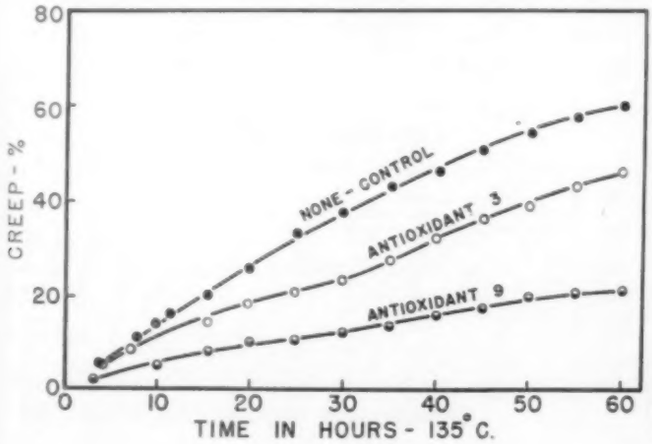


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Table IV.—Cold Flow at 120° F., 4000 p.s.i., 24 hours.

Material	*Cold flow*
	%
Phenol-formaldehyde	0.4
Urea-formaldehyde	0.4 to 7.0
Polyvinyl chloride	1.0 to 32.0
Cellulose acetate	2.0 to 64
Cast phenol-formaldehyde	10.0
Benzyl cellulose	76
Hard rubber	0.5 to 80

sirable to have more complete data over a wide range of temperatures. This is particularly important for rigid materials in testing the validity of the activation energy equation. In the field of elastomers, the present low temperature data seem doubtful to some extent because it is not known that all curves can really be superposed completely. The torsional creep method should prove very useful in carrying out this work. Perhaps investigation of the fourth low temperature region as indicated by Tobolsky will clarify the matter.

Literature is practically non-existent on the practical application of the valuable theoretical work on stress relaxation and creep for elastomers. It would be valuable to have creep data available for a range of antioxidant and accelerator types. Little is known of the relative precision of creep and relaxation measurements although the indications are that these are a considerable improvement over conventional methods of assessing such properties as acceleration and antioxidant effectiveness. Perhaps information will be available soon in which actual road test results may be correlated with creep and/or stress relaxation data in tire carcasses and tubes.

The evaluation of the creep and allied properties of elastomers for low temperature application is far from being satisfactory at present. The work of Conant and Liska (26) on bending creep by means of Young's modulus has been unusual in the respect that it has been a more fundamental approach. Aiken, Alfrey, Janssen, and Mark (17) have carried out creep tests on plasticized polyvinyl chloride over extremely long ranges of time and temperature in studies designed to evaluate fundamental plasticizer characteristics. Correlation of these findings with extensive service data has not, as yet, been published.

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Sorry!

The maximum and average densities of Grade L laminate given in Table I, page 124 of the May issue of MODERN PLASTICS, were inadvertently given as 1.34 and 1.37 respectively instead of 1.37 and 1.34 respectively. This table appeared in the article, "Cotton Fabric Laminates," by R. K. Witt, P. D. Wolfe, and D. M. Rust.

Paste Dispersions

(*Continued from page* 144)

Only those that were adaptable to paste use and were used commercially are described in this report.

Tricresyl phosphate. — This is the only plasticizer used in Germany for pastes that is also well known in America. Its good mechanical strength when used in high concentrations and its excellent heat resistance makes this one of the most popular for use in pastes.

Mesamoll I. — Esters of phenol and sulfonic acid chlorides derived from Fischer-Tropsch hydrocarbons. This plasticizer resembles tricresyl phosphate in its behavior in pastes although Mesamoll's cold resistance is better. It is, however, more volatile and water sensitive than tricresyl phosphate. Good mechanical strength with high proportions of softener and good resistance to heat makes it especially well suited for pastes.

Palatinol F. — Phthalic diesters of C_7—C_9 mono alcohols formed by hydrogenation of their acids. Also known in Germany as ED-242. The acids were distilled off of air oxidized Fischer-Tropsch hydrocarbons. This is one of the best plasticizers from the standpoint of indifference to temperature variations, especially cold. Its good electrical properties and fastness to light coupled with its good mechanical strength classifies this as a good all-purpose softener and one of the most popular for paste use.

Palatinol HS.—Phthalic esters of hexyl and heptyl

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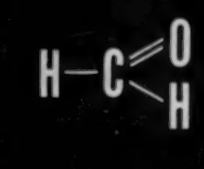

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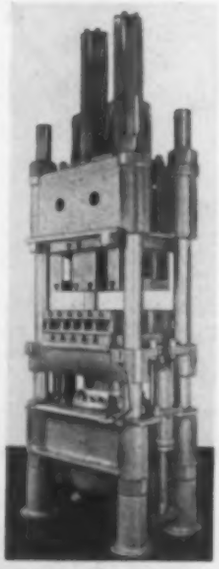

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alcohols which are by-products formed from the synthesis of methanol at Leuna. Since this plasticizer is more volatile than Palatinol F it is not preferred for the manufacture of thin coatings from paste. It has shown excellent electrical insulation values and good mechanical strength.

Elaol IK. — Hexanetriol, obtained as a by-product in the butylene glycol stage of the butadiene synthesis, is esterified with synthetic fatty acids of the C_4—C_6 series. This plasticizer is suited for dispersion work because of its resistance to extremes of temperature and its good mechanical strength at high concentration and its good solvency power at low concentration.

Plastomoll KF. — Triethylene glycol ester of synthetic fatty acids of the C_6—C_{10} series. It is desired for pastes because of its excellent softening effect on PCU-P. It must be used with other plasticizers because it tends to become sticky at high concentrations when used alone. The outstanding characteristic is its good low temperature resistance. Its insulating properties are poor.

Plastomoll TAH. — Thiodibutyric acid ester of ethyl hexanol. Considered to be the best plasticizer for polyvinyl chloride developed in Germany.

Although different plasticizer types in commercial quantities were limited because of raw material shortages, the following ideas had been formulated for further development. Pastes require high concentrations of softeners (40 to 60%) to provide proper flow conditions at room temperature. It was found that by selecting plasticizers with high viscosities, fused compositions with high hardnesses were obtained despite the fact that a large amount of plasticizer had been used. It was also found desirable to use plasticizers having viscosity-temperature curves of flat slope. If one with a steep slope were used it would yield compositions that flowed badly and tended to become sticky at elevated temperatures, and brittle at low temperatures.

These facts are demonstrated by the data shown in Table II, comparing three plasticizers, suitable for pastes, with dibutyl phthalate which is recognized as being unsatisfactory.

It should be realized that the foregoing discussion sets forth the requisites for components of an ideal paste. An ideal paste is a dispersion of maximum stability for shipment and long time storage, and with an ease of operation for the consumers using it in many different types of applications. Pastes may be prepared from a wide variety of resins and plasticizer grades and types. This was being demonstrated in Germany due to zonal restrictions on shipment of raw materials. When the use was small and the paste was to be consumed in a matter of days after preparation, "shelf life" or stability did not assume any importance. Further, the viscosity of the paste could be easily altered to suit the particular application or piece of equipment used to apply it. This was done by blending batches of different resins

and plasticizers that were known to yield dispersions of high and low fluidity.

Paste manufacture

Until near the end of World War II, I. G. Farbenindustrie A.G. at Bitterfeld was the sole manufacturer and supplier of PCU-pastes. Although experimental quantities of many different formulations were made, their large production, which was over 7,000,000 lb. per year, consisted of the four main types shown in Table III. Formulae utilizing other plasticizers are listed in Table IV.

The pastes made at Bitterfeld were sold in 12 and 15-metric ton shipments via insulated iron tank cars. Smaller iron and glass flasks of about 50 to 60 kg. were also shipped. Pastes to be used for gloves, foil, or thin coatings were all deaerated by drawing a vacuum on the paste before it left the plant. The pastes were charged to and discharged from the tank cars with the aid of nitrogen pressure of 60 p.s.i.

Either a Werner and Pfleiderer or a change can type mixer was used to blend the plasticizer, resin, filler, and other ingredients such as dyes, pigments, stabilizers, or antitack agents. Usually one hour sufficed for this operation. This thick material of dough-like consistency was then given one or two passes through a three-roll paint mill which produced a homogeneous dispersion of higher fluidity. The usual viscosity was in the range of about 5000 centipoises. They varied from a mayonnaise to a toothpaste-like consistency and would usually support a stirring rod stood on end in a beaker of the paste. No absolute viscosity measurements were made. One simple test consisted of immersing a hydrometer-shaped piece of aluminum in the paste and then, with a stopwatch, checking time required for the distance between two marks on the stem to sink below the surface.

As mentioned previously, it was often necessary to blend different batches to obtain a desired con-

Table IV.—Miscellaneous PCU—Paste Formulae (Compositions given in parts by weight).

Ingredient	*Composition*							*Foams*		
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
PCU—P	24	24	45	58	45.5	60	58	58	60	42.4
Tricresyl phosphate					45.5				30	
Mesamoll I	8	8	51	25			25	25	10	50.8
Palatinol F	8							17		
Palatinol HS						40				
Elaol IK		8					17			
Plastomoll KF				17						
Porophor N									20	
Calcium carbonate			4		9					
Water										6.8

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sistency. A ribbon-type blender was used for this. Pastes which had been stored for long periods of time were also mixed in this blender as this type of dispersion displayed some thixotropic properties. The rise in viscosity resulting from this property was reduced by a short mixing period. One type of mixer that had gained some preference was a single roll mill having a bar drawn up close to the roll surface. Low initial cost and easy cleaning were its principal advantages.

Colors were never added at the Bitterfeld plant. Procedures for the addition of dyes and pigments in the plants of fabricators, who made their own pastes, varied in that some dispersed the color in plasticizers on a mill before adding it to the resin. For pastes received from Bitterfeld the colors and other addition agents had, of course, to be added dry.

It was interesting to note that none of the common American practices, such as the use of solvent dispersions of resin and plasticizers, were used in Germany. Neither were ball mills ever used to prepare the pastes or solvents employed to control the consistency of the dispersions.

Paste dispersions applications

Coated fabrics. — This use constituted the largest single outlet of pastes. One of the principal advantages of pastes in this application was the fact that the film adhesion to the cloth backing was superior to calendered coatings. (Thin solution coatings are usually applied in the United States to provide good adhesion of calendered coatings).

Pastes were of ideal consistency for coating or spreading work, because they permitted thick or thin films to be cheaply and rapidly deposited. Usual thicknesses of light weight coatings were 2 to 3 oz. per sq. yd., and heavier coatings were utilized for simulated leather goods, about 10 to 12 oz. per square yard.

The usual method of application roughly consisted of applying the first coat with a doctor blade, after which the coated cloth was heated for 3 to 4 min. at 71° C. (160° F.) to merely set the paste. In the case of heavier coatings the cold paste was flowed onto the base coat from an overhead storage tank. The coating thickness was then determined as the cloth passed under a spreader blade which removed the excess paste. Fusion of the sheet was effected by passing the coated fabric through a chamber heated to 160° C. (320° F.) with hot air. One instance was also noted of heating the film under ordinary high voltage bulbs (not infra-red). It was possible to emboss these heavier coatings by passing them, while still in the state of fusion, over a cooled patterned roll. This eliminated the usual reheating operation, thus effecting an additional saving.

Samples of truck seat covers made from pastes and still in good condition after continuous use for 6 years were displayed at the Ludwigshafen plant. Folding tops for open automobiles had been made

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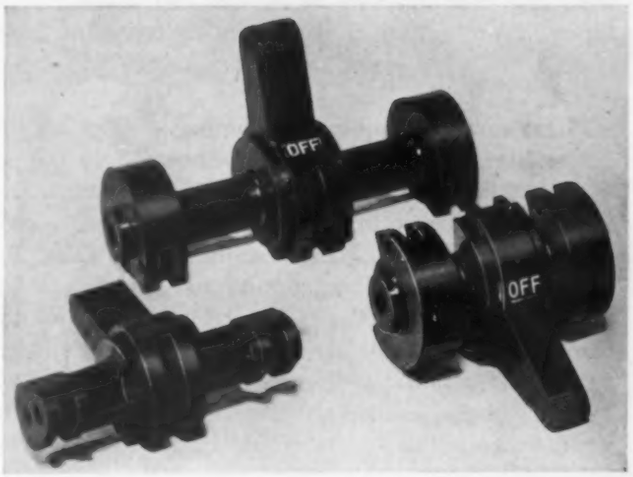

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and given good service. These consisted of a light fabric sandwiched between two coatings of plasticized polyvinyl chloride. Synthetic and natural jute were coated with paste to make bags for shipping corrosive commodities. Many other types of cloth with thin coatings of vinyl were also made for all types of protective clothing and shipping of foodstuffs.

Films and unsupported sheeting. — The biggest outlet here was in shoe soles. Sheets 3 to 5 mm. (0.12 to 0.20 in.) were made by depositing successive coats of paste on a fine basket weave bronze screen and then heat treating the film at 160° C. (320° F.) after each coat. The continuous screen passed through a stream of gas heated air to effect the fusion. A bonding surface was provided by the rough surface produced by the screen. The purported advantage of paste shoe soles was the fact that they were without the strains found in soles made from calendered sheet.

Metal foil was coated experimentally for packaging purposes. The thin coating of plastic permitted the wrapper to be heat sealed.

Unsupported foil was also deposited experimentally from pastes onto continuous nickel bands.

Dipped goods. — Industrial and surgeons gloves (0.080 and 0.010 in., respectively) were made by dipping aluminum forms preheated to 120° C. (248° F.) in the paste and then withdrawing slowly to allow proper drainage. A heating period of 10 to 30 sec. at 160° C. (320° F.), dependent upon the thickness, set the paste. Tensile strength as high as 2280 p.s.i. and an elongation value of 400% were claimed for some of these.

Entire boots were made in a similar manner. Other dipped articles included finger cots, grommets and irregularly shaped tubing.

Foams. — In addition to the usual foaming agents such as ammonium carbonate, two new compounds known as Porophors were used in pastes. Porophor N (azoisobutyrodinitrile) was the first that was widely adopted. Because the use of this compound was restricted due to toxicity, Porophor 254 (azodihexahydrobenzodinitrile) was developed.

Experiments were tried in adapting the French process used for rubber foams. This consisted of dissolving nitrogen in the paste at high pressures, fusing, and then expanding. Another method involved incorporating a small amount of water in the plasticizer used for the paste to utilize the steam at 160° C. for the foaming agent.

Although neither of the latter two methods were too successful, the Porophors produced excellent unicellular foams from pastes that were widely used for non-sinkable boats, fireproof insulations, cushions, tubing to keep steel cables afloat, and various types of mats.

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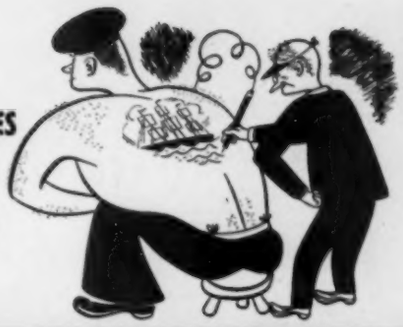

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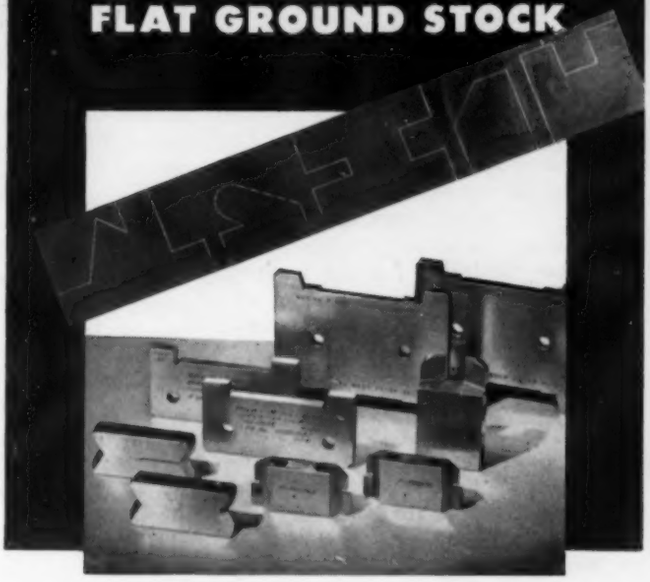

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INTERPRETATIONS OF THE CURRENT NEWS

By R. L. VAN BOSKIRK

Polyethylene for frozen food

THERE is no reason why polyethylene should not eventually walk off with a major portion of the market in frozen food packaging, according to an authority on film who has an unbiased viewpoint. He says that it is outstanding in low-temperature characteristics; it has no tendency to show brittleness until the thermometer reaches −50° F. Frozen food is processed at −20° F. and kept in storage at −10° F., so there should be no trouble here with brittleness.

Another desirable feature is that the water vapor transmission of polyethylene seems to get even better at low temperatures. It is true that the film is not transparent, but it does not necessarily have to be clear in this type of packaging.

It is pointed out that polyethylene is difficult to heat seal because the gage is not always uniform, and the softening point is rather sharp. A uniform gage might be obtained by solvent casting, but that is considerably more expensive than the commonly used hot extrusion process.

Polyethylene isn't a good barrier to some gases, says our authority, and this might be objectionable in some types of meat packaging; but turkeys have been successfully packed in polyethylene, and it might be possible for this trend towards poultry packaging to spread to other types of meat.

Machinery needed—It will also be necessary for a machine to be designed for automatic packaging that will use polyethylene, and our informant hopes that the material's great promise may not be set back by attempts to use machines designed for other packaging materials. In most cases such attempts have been failures in the past.

Another factor in favor of polyethylene for this purpose is its potential low cost. The raw material, ethylene, is not too expensive, and large-scale production induced by the many uses for polyethylene may help to speed achievement of that low-cost goal. One factor of cost is the extremely high pressure equipment necessary in the manufacturing process. In Germany, polyethylene has been polymerized under about 20,000 p.s.i. pressure, but the pressure used in this country has not yet been publicized.

*U. S. Patent Office.

Vinyl abrasion tester

TECHNICIANS at Southbridge Finishing Co., Southbridge, Mass., have developed a new vinyl abrasion tester. They say that existing methods for abrasion testing of vinyl are inaccurate, mainly because the vinyl heats up and clogs the abrader.

The new machine has a revolving centerpiece with loops of sandpaper attached to it and spring steel pieces inside the loops. The test specimens are clipped at three points around pipes which are water cooled to keep the vinyl from overheating. When the machine is set in motion, the whirling loops of sandpaper brush against the vinyl.

The specimens can be set on the tube so that they may be tested for abrasion either on the edges or on flat surfaces. Southbridge technicians say that the most important test is for abrasion at corners or bent edges and that their machine was designed primarily for that purpose. Furthermore, a fair test can be made in 2 or 3 hr. in comparison with many days when using previously designed machines.

Plastic coated yarns

FOR the past two years, there has been considerable experimentation with and development of various processes for coating yarn or string with vinyl. Various systems have been tried, including latices, pastes, organosols, extrusion over the yarn, and a film wrap. The finished material has a multitude of uses, including woven goods of various types that may be used for upholstery, rainwear, and shoe uppers. The advantage of a woven vinyl coated fabric in these applications is that it would permit the fabric to breathe.

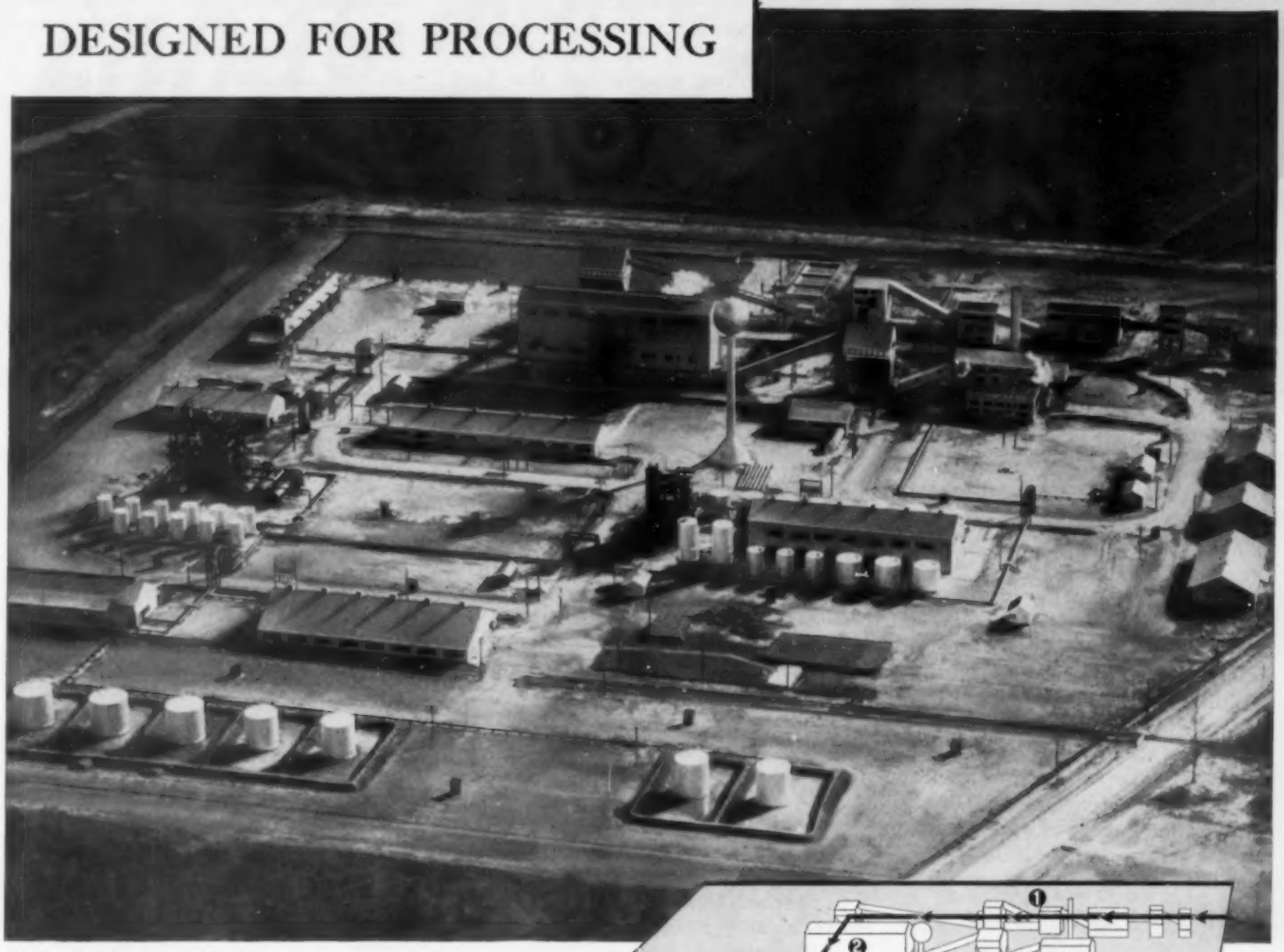
The latest announcement concerning any of these processes has recently come from The B. F. Goodrich Co., Akron, Ohio, through its Koroseal division. It reported production of a vinyl coated glass yarn fabric with ability to breathe and having good "hand" or drape. It is claimed that the new fabrics can be sewn or heat sealed, with the sealed bond as firm as that obtained on any other vinyl film. They are at present being offered in black and white and nine pastel colors and can be woven, braided, or crocheted. Various widths are available—from those needed for shoe laces up to 72 in. wide. Other multifilaments, including nylon, rayon, cotton, silk, and wire can and will be utilized later.

Film is stretched—The fabrics now being offered are covered with a 2-mil cast vinyl film which is stretched or racked down to a 1 mil thickness when applied to the glass yarn. It is called the Tensolite process and was described on page 113 of the November 1947 issue of MODERN PLASTICS.

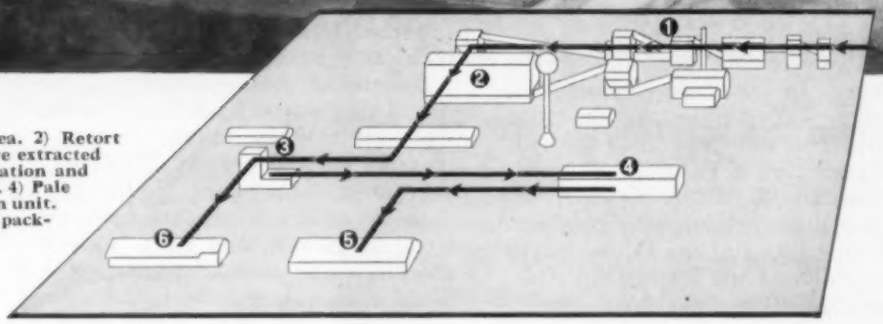
The unique feature of the process is the application of a vinyl tape parallel to the core rather than wound around it spirally. The vinyl film is first slit to form rolls of tape, and electrically heated rollers are used to bring the tape to the temperature required for complete lamination and coalescence. The tape is then threaded in a machine which rolls the tape into a continuous tube around the core. The process eliminates thin spots which might wear more quickly and gives a uniform diameter, a very important necessity in textile processing. Each core is double wrapped with vinyl film, and the heat sealing eliminates all pinholes into which moisture might penetrate.

Combination of the vinyl and glass yarn provides an article that is exceptionally utilitarian. It is grease-, chemical-, and oil-resistant and is particularly applicable in situations where flame resistance is necessary. Even though the vinyl might be melted off by direct exposure to flame, the glass will not be affected nor its strength reduced. These

DESIGNED FOR PROCESSING



© Photograph by Elwood Payne



1) Wood preparation and grinding area. 2) Retort building where terpenes and rosins are extracted by solvent. 3) Finishing unit for distillation and separation of solvent, terpenes and rosins. 4) Pale rosin decolorization and solution evaporation unit. 5) Rosin packaging building. 6) Oil loading and packaging building.

The Naval Stores Extraction Plant for Newport Industries, Inc., at Oakdale, Louisiana, provides for complete processing of pine stumps, from wood preparation to decolorizing rosin and packaging rosins and terpenes for shipment. Newly developed applications of continuous flow processing, and efficient fractionation result in products of the highest obtainable quality. This plant, with related facilities, was designed and constructed by Stone & Webster Engineering Corporation in collaboration with the engineers of Newport Industries, Inc.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

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factors make the material exceptionally adaptable for such things as drapes and curtains, table cloths, bedspreads, slip covers, automobile seat covers, and seats of various types in railroad cars, theaters, etc.

Borden expansion

EVIDENCE of the Borden Co.'s increasing tendency to make an important contribution to the plastics industry was indicated last month when the parent company announced formation of a Chemical Div. to take over the activities of Casein Company of America and Durite Plastics, Inc., Borden subsidiaries.

William F. Leicester, a Borden vice-president, who has headed the company's casein and plastics operations, will serve as president of the Chemical Division. Emil E. Novotny, founder and president of Durite before its purchase by Borden last October, was named executive vice-president of the Chemical Division. Mr. Novotny was a pioneer in the development of phenol - furfural thermosetting resins. The vice-presidents are Nils Anderson, Jr., H. P. Fell, C. S. Leonardson, and Ernest E. Novotny, Jr.

Immediate plans of expansion call for tripling of the formaldehyde production at the Springfield, Ore., plant; doubling resin production in the Durite plant; increased production of synthetic resins for use in bonding sand cores as used by the foundry industry; and further development of adhesives for radio-frequency bonding in the furniture and plywood industries.

The company is now strictly a raw materials producer since its interest in American Plastics Corp., molders of casein products, was sold to Heyden Chemical Corp. last Fall.

Although the Chemical Div. is small in comparison with its giant parent, the company has let it be known that it expects to increase its plastics operations in considerable volume. It has been estimated that the Chemical Div.'s 1948 sales will be over $10,000,000; Borden Co.'s total net sales in 1947 were over $600,000,000.

Because of costs involved in freight shipments, Borden is meeting its shipping problems by buying part of its chemicals from other manufacturers in the East—thus, it is cheaper to buy formaldehyde from another supplier in the East than it is to ship from Oregon. It is possible that this problem may be overcome by construction of a series of small plants strategically located near raw materials and customers. Borden is not the only company that has been thinking of this evolution from large to small factories. Long before the war there was a trend towards construction of small plants in scattered areas rather than erection of one big plant in concentrated population or raw materials supply areas.

Insulation material

ANOTHER plastic material by U. S. Rubber Co. was announced during the month under the name of U. S. Flotofoam. It is reportedly a foamed urea in combination with other soluble resins which combines low thermal conductivity with a light weight of from 0.8 to 1 lb. per cu. ft. in shredded form, and 0.8 to 1.5 lb. in block form. Blocks and slabs can be produced in a variety of sizes and shapes to fill specified cavities and can be surfaced with paper, cloth, or resin coatings. The shredded form is easy to pour and pack into irregular cavities.

Because of the insulating properties of this plastic foam, refrigerator walls can be made thinner, thus increasing storage capacity. It is non-corrosive, non-toxic, self-extinguishing, will not support mold or bacteria growth, and holds its insulating value over a wide range of mean temperatures.

Present applications include shipping containers for fresh and frozen foods and commercial and home refrigeration units. Other practical uses are said to be transportation refrigeration in trucks, railroad cars, ships, and airplanes. The material is also reported to be suitable for flotation purposes, for soundproofing, and for display and novelty uses.

More about Versalite

MORE information is beginning to come in on the new type thermoplastic known as Versalite and produced by the U. S. Rubber Co. From a patent entitled "Composition of Butadiene-Acrylonitrile Copolymer and Styrene-Acrylonitrile Copolymer," assigned to the United States Rubber Co., we have obtained the following summary:

Several types of resins are listed under the one patent. One is a hard, tough, thermoplastic molding composition which will not soften or deform in boiling water. Another is a leather substitute obtained from a synthetic rubber-resin mixture.

The materials used are given as Buna S and Buna N rubbers, acrylonitrile, styrene, a peroxidic catalyst, modifiers, and emulsifying agents.

As examples, the patent gives one as consisting of 65 parts by weight of a styrene-acrylonitrile copolymer, derived from a monomeric mix consisting of 30% acrylonitrile and 70% styrene, with a resulting copolymer that has a softening point of about 200° F. After mixing at a temperature of from 300 to 400° F. and the addition of 34 parts of Buna N, the material is calendered in sheets of one or more plies and pressed on a hydraulic press or otherwise at pressures in the range of 200 to 1000 p.s.i. at a temperature of from 300 to 335° F.

Instead of molding in a platen press, the calendered sheets may be tiered and heated in a chamber with live steam and then cooled. The resulting sheet is hard and boardy and has a tensile strength of approximately 4600 p.s.i. and an elongation of from 30 to 75 percent.

Molded shapes may be obtained by heating flat pressed sheets of the material, drawing or stamping them into the desired shape, and then cooling while confined to the shape of the mold. They may also be molded while hot by laying them over a form and creating a vacuum to pull the sheet down tightly; it is then cooled to below the softening point of the sheet. The compositions of this variety which contain more than 50% by weight of the inelastic resin are readily molded to various shapes and are particularly suitable for applications where great resistance to deformation under sudden impact is required; for example, automobile fenders, protective helmets, golf club heads, golf ball covers, luggage, radio cases, etc.

The addition of sulphur or other suitable curing agent will raise the softening point of the composite thermoplastic about 10° F.

Extremely hard—Another composition consisting of: polydichlorostyrene, 40 parts; styrene-acrylonitrile copolymer resin (70:30), 40 parts; and 1,3 - butadiene - acrylonitrile (Buna N), 20 parts, is extremely hard. It is processed as above and is useful for molding cafeteria trays,

600 Per Hour

WITH

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SIMPLICITY
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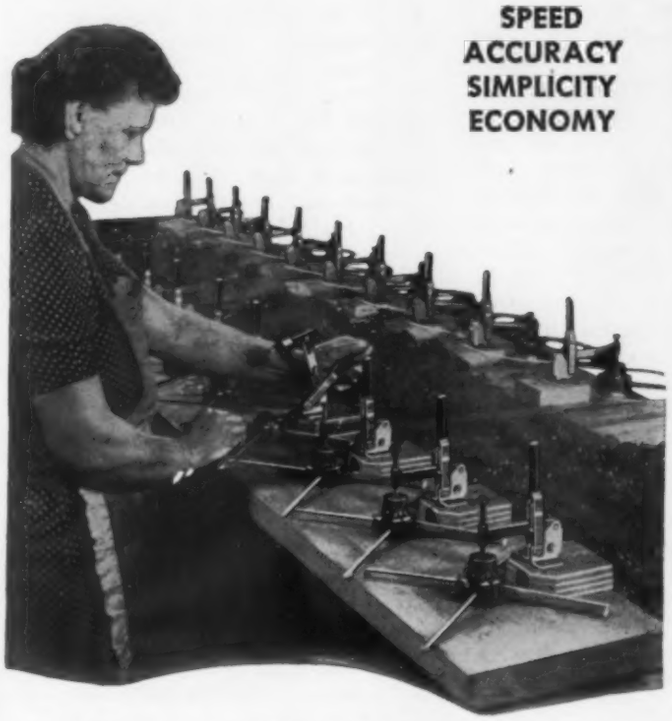

HELICOPTER ASSEMBLY with DE-STA-CO Toggle Clamps now stepped up to 600 per hour. Employing only four operators on this cementing bottle-neck, Stan-O-Matic Products turns out toys at the rate of over 250,000 a month. Their simple bench fixtures use series of DE-STA-CO 207-S Clamps.

BOOST YOUR VOLUME with DE-STA-CO Quick Action Clamps. Essential in many production operations such as welding, gluing, riveting or other holding jobs. For wood, plastic and metal. They're low in cost . . . high in productivity. Build your own EFFICIENT fixtures, quickly, economically!

De-Sta-Co toggle clamps are stocked by the following representatives:

CALIFORNIA: Los Angeles—Norman S. Wright & Co.; San Francisco—Norman S. Wright & Co. GEORGIA: Atlanta—Pye-Barker Supply Co. ILLINOIS: Chicago—Geo. A. Rieke Co. INDIANA: Fort Wayne—General Supply & Tool Corp.; Indianapolis—General Supply & Tool Corp. MASSACHUSETTS: Malden—F. H. Robertson Co., Inc. NEW YORK: Buffalo—Root-Neal Company; New York City—John F. Diehl Co.; Rochester—Fink Tool Co., Inc.; Syracuse—M. J. Kelly Supply Co. OHIO: Cleveland—Die Supply Co.; Dayton—E. C. George Co. OREGON: Portland—Norman S. Wright & Co. PENNSYLVANIA: Philadelphia—Mr. P. J. Fleming: Pittsburgh—Mr. W. P. Jones (Westval Products). TENNESSEE: Memphis—Lewis Supply Co. TEXAS: Dallas—Tool Supply & Engineering Co. WASHINGTON: Seattle—Norman S. Wright & Co. WISCONSIN: Milwaukee—Triplex Supply Co. ONTARIO: Windsor—Williams & Wilson Ltd.; Toronto—Williams & Wilson Ltd. QUEBEC: Montreal—Williams & Wilson Ltd.

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Many years' experience in producing both extruded and molded plastic parts have given us the skill. Ample plant facilities and up-to-date equipment have created a wide demand for HOPP quality products. Our large accumulation of stock dies and molds may save you time and money —or our engineers will custom-design to your precise specifications special dies and molds.

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cups, and hard rubber-like instruments which require sterilization in boiling water. Such a resin may also find useful application in the electrical field—in screw driver handles, insulators for contact plugs, electrical instrument mounting panels, telephone switchboard panels, etc.

The example given as a leather substitute consists of: styrene-acrylonitrile copolymer resin, 25 parts; Buna N, 75 parts; with zinc oxide, benzothiazyl disulfide, stearic acid, and sulfur. The material is calendered into sheets and then pressed between the platens of a hydraulic press. The patent claims that this composition does not harden even upon prolonged exposure to above-normal temperatures, as do many other simulated leather materials which contain volatile plasticizer.

Properties of this material, known in its various forms as Versalite, are given in the table above.

Properties of Versalite

Softening point: 160–220° F. Can be varied according to compound.
Tensile strength: 2000–9000 p.s.i.
Flexural strength: 5000–14,000
Izod impact: 10–18 ft.lb.in. (notch milled)
Dielectric constant from 3–14 depending on formulation, 50% RH, 60 cycles; 2.7–8, 50% RH, 1,000,000 cycles.
Modulus of elasticity: 1.5–2.3 x 10^5, p.s.i.
Water absorption: 0.16–0.40%
Rockwell hardness: 40–105 R scale
Thermal conductivity: 0.99–1.04 x 10^{-4}, Cal./cm.^{2}/sec./cm./° C. 0.92–0.97 Btu./ft^2/hr./in./° F.
Thermal expansion: 3–5 x 10^{-5}, in./in./° F. 6–12 x 10^{-5}, in./in./° C.
Dielectric strength: 160–1020, v/mil 50% RH 60 cycles
Power factor: 0.0112–1.05, 60 cycle, 50% RH 0.105–0.238, 10^6 cycles
Mold shrinkage, compression: 0.002–0.003, in./in.
Specific gravity: 1.04–1/15, 20/20° C.
Density 0.60–0.625 oz./cu.in.
Specific volume 25.6–27, cu.in/lb.
Elongation: 25–130%

Latex adhesives

LATEX which requires no heat for fusion and which is being used as a bonding agent in new non-woven fabrics was described by G. W. Flanagan of B. F. Goodrich Chemical Co., in a recent talk before the Association of Adhesive Manufacturers. These fabrics are the type used for tea bags, disposable handkerchiefs, etc., and the bonding agent most commonly used in the past has been reported as polyvinyl alcohol.

Mr. Flanagan also called attention to the latex for use as a coating agent for papers designed for frozen food packaging and in numerous combinations with other materials where heat sealing is now necessary. He further explained that the new latex, which requires no plasticizer, shows great promise as a plywood adhesive and that other latices which are mixtures of nitrile rubber and vinyl are also being used as a bond for plywood. Latices of high styrene-butadiene copolymers also are developing in this field. Such mixtures can be cured, and the curing process eliminates the objectionable property of thermoplasticity that is characteristic of an all-vinyl bond.

Another use for the latices is in paper sizings to make possible better detail in process printing. Preliminary studies have indicated that some of the latices may be mixed with starch, dextrine, or casein to improve adhesive characteristics. Another application is the coating of cellophane with vinyl latex.

Mr. Flanagan pointed out that combinations of materials were frequently more effective than one used alone. Thus, a vinyl latex-treated fabric will keep a subsequent coating of paste compounds on the surface and, therefore, not only improve the adhesion but also reduce materially the coating weight of the wearing surface necessary to insure long life.

Rubber film

WELL along in the development stage and almost ready for market is a new thin film made from chlorinated natural rubber and Hycar. It is expected that it will be offered for packaging use, particularly as a coating for glass containers, and in some types of wearing apparel.

Automobile kick plates

A REVAMPED material for lining trunk compartments in automobiles and for use in kick plates is being developed in the Midwest. The material presently used is an asphalt board coated with pyroxylin. Instead of the two or three conventional coats of pyroxylin, the developers believe that one coat of vinyl latex will be sufficient to do the job. In addition to these end uses, the vinyl latex coated board is being mentioned for truck cab linings and sun visors.

Innersole binding tape

USED for binding the edges of innersoles in women's shoes, Sulvyne tape has been announced by the O'Sullivan Rubber Corp., Westchester, Va. It comes in continuous lengths without splices and can be used with most cements and on conventional manufacturing equipment. Sulvyne tape is said to be low cost and easily applied to all types of innersoles such as cork, paper, fabric, and leather, and is available in all standard colors. Made from a blend of Geon polyvinyl chloride resins, it is claimed to be difficult to distinguish from high-grade calf.

Phenol in Germany

PHENOL production in the United Kingdom and United States zones of Germany is expected to reach 10,000 tons this year, according to Dept. of Commerce reports, with anticipated requirements placed at 25,000 tons.

During the last quarter of 1947, output of synthetic phenol amounted to 700 tons, while natural accounted for 370 tons. Two or three years are expected to elapse before plans for increasing the output of synthetic phenol materialize.

Tenite III withdrawn

Cellulose acetate propionate, or Tenite III, was withdrawn from the market last month by the Tennessee Eastman Corp. The implication is assumed that the company now has available an almost odorless cellulose acetate butyrate and feels that otherwise Tenite III had no particular properties superior to Tenite II, its butyrate compound. Thousands of butyrate telephone bases are now said to be in customers' hands with almost no trace of the pungent odor formerly peculiar to butyrate.

RAW MATERIALS

Methyl isobutyl ketone—A new book summarizing the properties and applications of this solvent has

Moisture Absorption less than 0.06%

that's Styron!

Parts illustrated are from current models of Kelvinator refrigerators, products of Nash-Kelvinator Corp.

WHY DO LEADING REFRIGERATOR MANUFACTURERS SUCH AS NASH-KELVINATOR SPECIFY POLYSTYRENE for vital parts such as throat liners, evaporator doors, drip receptacles and other applications?

Styron (Dow Polystyrene) is being used more and more by refrigerator manufacturers *because* it has very low moisture absorption. Hard, rigid, durable, Styron remains dimensionally stable even when *immersed in water for long periods!* Humidity or temperature variations in refrigerators cause no appreciable change in the shape or contour of these Kelvinator parts made of Styron.

Styron adds other advantages, too. It is ideal for mass production of identical parts. Gleaming color that won't chip or peel, resistance to stains, easy to wash, light weight, natural insulating properties, no taste or odor imparted to food—all these add up to the choice of Styron by molders and manufacturers where the *right* plastic is needed to do a job *right!*

DOW Plastics

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been published by Shell Chemical Corp. Especially useful for nitro cellulose lacquers, a methyl isobutyl ketone also finds utility in many types of vinyl resin solutions, particularly where it is desirable to modify evaporation rate.

In the organosol technique for application of vinyl coatings or the preparation of unsupported films, methyl isobutyl ketone is an effective dispersant. It helps to lower fusion temperatures and gives good solvent release characteristics which prevent soft or tacky films. Blistering of vinyl coatings generally can be prevented by use of this solvent. It has also been used to give low viscosity to surface coatings or adhesives based on acrylic ester type resins.

Although not an actual solvent for cellulose acetate butyrate, methyl isobutyl ketone is used in aircraft dopes of that material to adjust the evaporation rate. It is used also in saran-acrylonitrile copolymers as a solvent; in can coatings to reduce viscosity of phenolic solutions; and as a solvent of synthetic rubber cements employing butadiene-acrylonitrile copolymers. Requests for copies of this book should be made on business letterhead to Shell Chemical Corp., 100 Bush St., San Francisco 6, Calif., or 500 Fifth Ave., New York 18, N. Y.

Stabelan "XL", manufactured by the Stabelan Chemical Co., Toledo, Ohio, as a vinyl stabilizer is receiving considerable attention in the trade. It is reported to be different from other stabilizers in that it will improve the vinyl resins themselves rather than simply screen out the ultra-violet rays or perform as hydrochloric acid acceptors.

It is claimed that the average life of vinyl resin films has been trebled with the introduction of this new stabilizer. Used successfully in the ratio of from 3 to 6% in nearly all types of vinyl resins, it is non-toxic and the resulting film can be used for food packaging.

The company has also announced a special stabilizer for polyvinyl chloride latices, under the designation of Stabelan "G", to give a high degree of transparency and outdoor aging; however, Stabelan "G" is not recommended where the film might come in contact with food.

COMPANY NEWS

Jefferson Chemical Co., Inc., formed in 1944 by The Texas Co. and American Cyanamid Co., has announced that its plant near Port Neches, Texas, is now in full commercial operation. Among the products manufactured are ethylene glycol and ethylene oxide. Both are currently in short supply, and output of the new plant should alleviate that shortage.

The former material, used extensively in the manufacture of anti-freeze, cellophane, and resins, may help to ease the shortage of methanol which is also used in other types of anti-freeze to such an extent that it has hindered the availability of methanol for production of formaldehyde.

Ethylene oxide is one of the primary chemicals used in producing acrylonitrile and, according to company officials, the new production facilities should eliminate any worry over a possible shortage of that material for the next few years.

Chemical Development Corp., 100 Memorial Drive, Cambridge, Mass., has announced that it is prepared and equipped to undertake the processing, development, and manufacture of chemicals and chemical formulations on a confidential basis. This service is designed especially for those wishing to keep "secret" the source and formulation of materials, or to provide production for which its plant is not wholly suited, or to obtain products not readily available. Laboratory research can be arranged for through the facilities of the company's affiliate, Esselen Research Corp.

Shellmar Products Corp. reports a net profit of $1,862,771.56 for 1947, with earnings equal to $4.32 per common share. This compares with $1,403,951.91, or $3.21 per common share in 1946.

Among the new products produced by Shellmar of particular interest to the plastics industry are wrappers for fresh and frozen foods; the vinyl-nitrile rubber oleomargarine package; and the collapsible polyethylene milk bottle for infant feeding.

During 1947, over $2,000,000 was expended on new plants, expansion of existing buildings, and new equipment. Included was a new building at Zanesville, Ohio, for the production of oleomargarine pouches and other packaging materials. Additional space was provided at South Gate, Calif. and Mt. Vernon, Ohio. New high-speed printing presses and bag fabricating machines were installed at Mt. Vernon. At Palmer, Mass., plant capacity for the production of molded pulp egg cartons was enlarged, and a new egg carton plant is in process of construction at Morris, Ill., for production of Self-Locking egg cartons.

The Baldwin Locomotive Works, Philadelphia, Pa., large manufacturers of hydraulic equipment, is building six steam platen presses for the processing of plywood in the new plant of the Compagnie Francaise DuGaban now under construction at Port Gentil, French Equatorial Africa. Two of the presses will be 865 tons each with steam platens 106 by 65 inches. The four others will be 715 tons each and have steam platens 106 by 54 inches. Delivery is scheduled late this year.

Baldwin has also engineered a 715-ton special type steam platen press for processing of plywood from southern softwoods on a volume basis for the Hamilton Veneer Co., Orangeburg, S. C. The press will have 16 openings and 106 by 54-in. steam platens.

The Dow Chemical Co., Midland, Mich., has announced a 25% reduction in the price of Saran Film 517, generally used for foods, and Type M, a corrosion preventive packaging material for machinery.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced that construction has begun on its proposed $30,000,000 research laboratory in Wilmington. This will be one of the largest research establishments in the world and is scheduled for completion in 2½ years. The project will include 10 new laboratory and semi-works buildings for long-range research. Among the company's research organizations to be transferred to the new plant in Wilmington is the Plastic Dept. now at Arlington, N. J.

Lustra-Cite Industries, Inc., 225 W. 28th St., New York, N. Y., has announced development of a plastic cleaner and polisher known as "Statikleen" which is now available directly from Lustra-Cite or through its jobbers. The material is said to clean and polish in one operation,

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This striking miniature Treasure Chest—in beautiful plastic with gold decoration—was planned and molded, from start to finish, by our own staff of model makers and engineers.

EACH MOLDED plastic item should be a "treasure" to the consumer, incorporating lasting beauty, durability, color, charm and practical utility. Together, these things spell SALEABILITY!

YOU CAN COUNT on us for true precision molding plus an understanding of the factors that assure the utmost in "buy appeal." We never lose sight of the fact that products are designed to sell.

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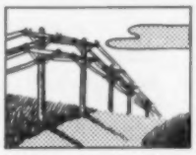
By covering them with extruded plastic, Rex may be able to improve the versatility of your present products or even create items which find entirely new markets.

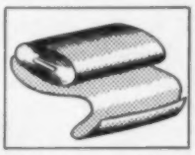
Rex extrusions are even and free from flaws. They adhere securely to the substances over which they are extruded. A wide range of bright, permanent colors are available, serving either for identification or decoration.

Here are several examples of improved, more serviceable products which resulted when Rex coated base substance with extruded vinyl plastic:

EXTRUDED VINYL PLASTIC COATING



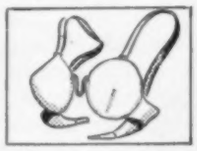
On copper wire. Used to make wire insulation.



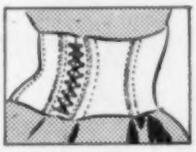
On thread. Used to make woven fabrics.

On cotton rope. Used to make dog leashes.

On soft iron wire. Used to make dress making forms.

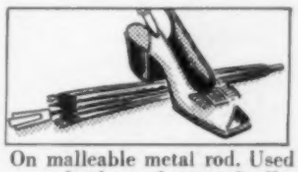


On steel spring wire. Used to make uplift brassiere supports.



On flat coil steel strip. Used to make corset stays.

On twisted paper. Used to make handles, jump ropes and giftwrapping.



On malleable metal rod. Used to make bag, shoe, umbrella, ornaments and fittings.

. . . . *and many other products, too.*

The proper application of the right plastic coating can make *your* product

- **BRILLIANTLY COLORFUL!**
- **WEAR RESISTANT!**
- **ADAPTABLE!**
- **A BETTER PERFORMER!**

Have you a *base substance* that we can cover by the continuous plastic extrusion method to make a new and better product? We would like to assist in its development. Write today.

THE REX CORPORATION

Cambridge 39, Mass.

New York Office:
152 West 42nd St., N. Y. 18, N. Y. WIsconsin 7-4143

Extruders of Tubes, Sheets, Insulated Wire and Cable, Welting, Rigid and Flexible Shapes

THE PLASTISCOPE

leaving a protective surface which overcomes accumulation of electrostatic charges in the plastic material and the resultant accumulation of dirt.

The Kopplin Molding Co., 1440 Blair Ave., St. Louis 6, Mo., has been recently organized to engage in custom molding by compression and transfer methods. The company has five new Stewart Bolling presses. Personnel consists of Karl Kopplin, president and general manager; A. H. Burris, vice-president for operations; G. E. Burris, plant engineer; and F. B. Sanders, general foreman, all of whom recently left the Plastics Molding Co., St. Louis, Mo., to organize the new firm.

Delton Products Corp., 154 Nassau St., New York, N. Y., has expanded its operations in chemicals and waxes to include a complete line of plastic molding powders, sheets, rods, and tubes. All principal types of plastics will be handled primarily for the export trade. Dr. Samuel Krasner, who has been a consulting plastics engineer for more than 25 years, is in charge.

Plastic Industries Technical Inst. has removed its offices to 31-28 Queens Blvd., Long Island City, N. Y.

Manco Products Co., developers of beryllium copper as used in the production of cavities and cores for plastic molds, has purchased a new plant at 2401-2409 Schaefer Rd., Melvindale, Mich., where it will continue to manufacture precision fabrications under the trade name "Tru-Cast."

M. A. Nichols, formerly vice-president and sales manager of the Process Mold and Mfg. Co., is president of the new organization.

Mathieson Chemical Corp. is the new name of the former Mathieson Alkali Works, Inc., 60 E. 42nd St., New York, N. Y. The corporate organization remains the same.

Durez Plastics & Chemicals, Inc., is now selling its phenolic molding compounds on the West Coast directly to the user as it does in all other sections of the country. Evan E. Graham, sales engineer, has been assigned the territory and will headquarter in Los Angeles, Calif.

Emeloid Co., Inc., began operation in its new plant at Hillside, N. J., a suburb of Newark, on April 17. The company's former home was at Arlington, N. J. More than 40,000 sq. ft. of space has been provided in one single-story building.

PERSONAL NEWS

Dr. George O. Curme, Jr., has been elected vice-president, Chemical Research, at Union Carbide and Carbon Corp., 30 E. 42nd St., New York, N. Y. Dr. Curme has been for many years a vice-president and director of Bakelite Corp. and Carbide and Carbon Chemicals Corp., both important units of Union Carbide.

Dr. Curme is a pioneer in the American organic chemical industry. As a result of his research work, he has witnessed commercial output of his findings expand to an annual production of over 9,000,000,000 pounds. These products include synthetic ethyl alcohol, ethylene glycol, acetic anhydride, vinyl plastics, and some 200 other aliphatic chemicals.

Langdon P. Williams has been appointed director of public relations for The Society of the Plastics Industry, Inc. Mr. Williams formerly conducted his own business in public relations, advertising, and publicity in New York, N. Y.

Clayton I. Spessard has been assigned to the Bakelite Corp.'s Los Angeles district sales office at 1709 W. Eighth St., as technical representative serving coatings and adhesive manufacturers and film and sheeting fabricators in the Pacific Coast area. Mr. Spessard has been with Bakelite Corp. and Carbide and Carbon Chemicals Corp. for over 12 years where he specialized in the dispersion technique which has resulted in the development of organosols and plastisols.

William D. Caddell, formerly designer and advertising manager for Hamilton Associated Industries, Inc., Chicago, Ill., has announced the establishment of William Caddell Associates, 2440 Estes Ave., Chicago, Ill. The firm will engage in a creative product development program embracing both design and merchandising. Mr. Caddell will also serve as sales manager for Anfinsen Plastic Molding, New York St. Road, Aurora, Ill., specializing in injection molded items.

Dr. Louis C. Barail has been appointed chairman of a committee on skin irritation and sensitization newly organized by the Society of the Plastics Industry. Dr. Barail is head of the Dept. of Biology and Bacteriology of the United States Testing Co., Inc.

Walter Wagner has disposed of his interest as an officer and director of Heider and Wagner and has established the Walter Wagner Corp., with finishing, packing, and shipping facilities for plastics products, in Ridgewood, N. J. A New York office is located at 545 Fifth Ave., where Edwin D. Maibrunn is in charge.

D. O. Van Ness has been appointed general sales manager of Industrial Molded Products Co., Inc., 5201 N. Avondale Ave., Chicago, Ill. Mr. Van Ness is a former sales engineer for Bakelite as well as general manager of a plastic molding plant.

W. G. Appel, formerly of the Cambridge, Ohio, office of Continental Can Co., Inc., has been transferred to the company's Chicago office at 135 S. LaSalle St., in the capacity of district sales manager.

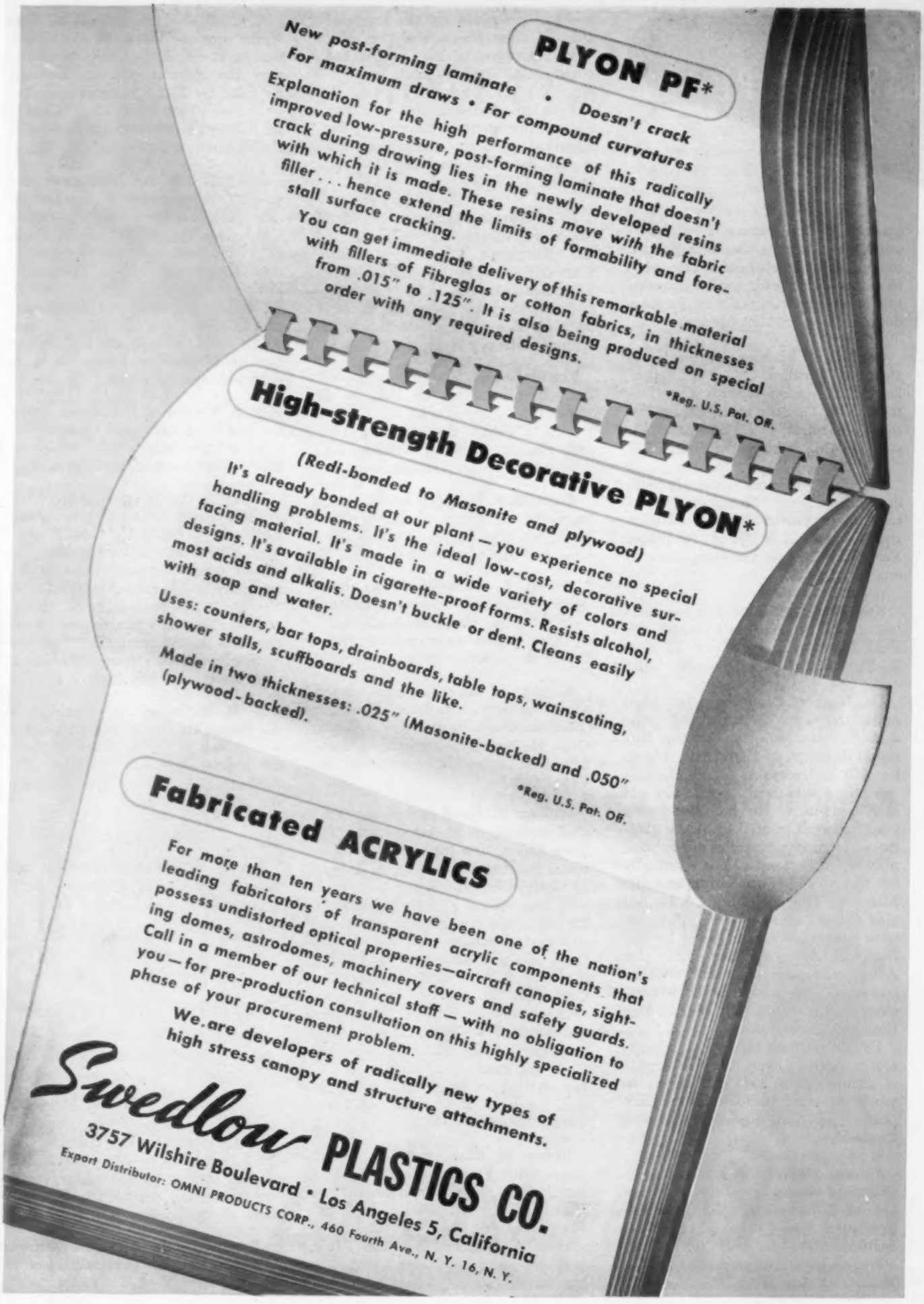
George B. Rheinfrank, Jr., has been named manager of market analysis at Plaskon Div. of Libbey-Owens-Ford Glass Co., Toledo, Ohio. He will be responsible for trade and market research work associated with the sale of all Plaskon products.

George DeBell, consulting engineer to the plastics industry, has returned to his consulting practice in the East after completing a three-month consulting assignment with Plastic and Die Cast Products Corp., Los Angeles, Calif.

B. J. C. van der Hoeven has been appointed a vice-president in the Chemical Div. of Koppers Co., Inc., Pittsburgh, Pa. He will also retain his duties as assistant general manager of the company's Chemical Div.

Carl Bondhus, formerly of McCann-Erickson's Outdoor Dept., has been appointed sales manager of Colonial Displays, Inc., 1500-48th St., North Bergen, N. J.

With the recent addition of a new


PLYON PF*
New post-forming laminate • Doesn't crack for maximum draws • For compound curvatures
Explanation for the high performance of this radically improved low-pressure, post-forming laminate that doesn't crack during drawing lies in the newly developed resins with which it is made. These resins move with the fabric filler . . . hence extend the limits of formability and forestall surface cracking.
You can get immediate delivery of this remarkable material with fillers of Fibreglas or cotton fabrics, in thicknesses from .015" to .125". It is also being produced on special order with any required designs.
*Reg. U.S. Pat. Off.
High-strength Decorative PLYON*
(Redi-bonded to Masonite and plywood)
It's already bonded at our plant — you experience no special handling problems. It's the ideal low-cost, decorative surfacing material. It's made in a wide variety of colors and designs. It's available in cigarette-proof forms. Resists alcohol, most acids and alkalis. Doesn't buckle or dent. Cleans easily with soap and water.
Uses: counters, bar tops, drainboards, table tops, wainscoting, shower stalls, scuffboards and the like.
Made in two thicknesses: .025" (Masonite-backed) and .050" (plywood-backed).
*Reg. U.S. Pat. Off.
Fabricated ACRYLICS
For more than ten years we have been one of the nation's leading fabricators of transparent acrylic components that possess undistorted optical properties—aircraft canopies, sighting domes, astrodomes, machinery covers and safety guards. Call in a member of our technical staff — with no obligation to you — for pre-production consultation on this highly specialized phase of your procurement problem.
We are developers of radically new types of high stress canopy and structure attachments.
Swedlow PLASTICS CO.
3757 Wilshire Boulevard • Los Angeles 5, California
Export Distributor: OMNI PRODUCTS CORP., 460 Fourth Ave., N. Y. 16, N. Y.

THE PLASTISCOPE

plant in East Paterson, N. J., Colonial service has been expanded to include plastic sheet fabrications in combination with screen processing, and fluorescent lighting for outdoor and spectacular displays.

Robert J. Metzler, formerly of Hercules Powder Co., Wilmington, Del., and Hagan-Whytte Co., Detroit, Mich., is now sales manager of the Cap Liner Div., Standard Insulation Co., East Rutherford, N. J.

Joseph T. Demers, formerly with the Plastics Div. of Monsanto Chemical Co., has joined Venango Plastics, Inc., custom injection molders, Franklin, Pa., as vice-president in charge of sales.

Roy Peat, well known in the plastics industry, has established the Peat Manufacturing Corp. at 8700 E. Firestone Blvd., Downey, Calif.

Dr. Herbert Leaderman has been appointed to the Division of Organic and Fibrous Materials of the National Bureau of Standards, where he will do research on the fundamental mechanical properties of high polymers. He has previously been engaged in studies of the elastic and creep properties of rubber, plastics, and textile fibers, chiefly for the Textile Foundation and the Firestone Tire & Rubber Co. He has also done development work on wire resistance strain gages for the National Advisory Committee for Aeronautics and on radar antenna housings (radomes) at the Massachusetts Institute of Technology Radiation Laboratory.

Dr. Leaderman received his bachelor's degree from the University of Cambridge in 1934 and began his work on rigid plastics at the laboratory of Aero Research Limited, England.

Games Slayter, vice-president in charge of research and development, Owens-Corning Fiberglas Corp., was presented the Industrial Research Institute Medal for 1948 "for his outstanding contribution to the field of industrial research; the development of processes for the manufacture of glass fibers, and the effective integration of his research into commercial applications."

John A. Britton, Jr. has been elected president of Enjay Co., Inc., chemical products marketing affiliate of Esso Standard Oil Co., succeeding H. W. Fisher.

Dr. Frederic Matthews has been appointed director of research for the Merrimac Div. of Monsanto Chemical Co. The Merrimac Div., with headquarters in Everett, specializes in paper, leather, textile, and surface coating chemicals, as well as in heavy chemicals.

Erwin Reveri, designer and production fabricator of displays in plastics in New York, N. Y., has joined Plastics Productions, Inc., 1602 Pauger St., New Orleans, La., fabricators of acrylic plastics.

Kenneth V. McCaleb has been appointed superintendent of the Cornelia, Ga. plant of the Lumite Div., Chicopee Manufacturing Corp.

Robert C. Hesselbart has been named technical service representative for glues and industrial resins by the Libbey-Owens-Ford Glass Co., Toledo, Ohio.

Kenneth L. Edgar has been named sales manager for Velon films for the Firestone Plastics Co., Akron, Ohio. He has been Firestone's Eastern Div. sales representative on Velon film.

William H. MacHale has accepted chairmanship of the Exposition Publicity Committee for the Third National Plastics Exposition being held at Grand Central Palace, New York City, September 27–October 1, 1948. Mr. MacHale is sales promotion and advertising manager of the Plastics Dept. of the Plastics and Resin Div. in the New York office of American Cyanamid Co.

Other members of this committee are Edward J. Pechin, advertising manager of the Plastics Dept. of E. I. du Pont de Nemours & Co., Inc., Arlington, N. J., and Don Masson, manager of publicity, Bakelite Corp., New York, N. Y.

Robert M. Bliss, associated for 20 years with Finnell System at Elkhart, Ind., has joined Industrial Plastics Corp., Elkhart, Ind., as office manager and sales manager. Gerald A. Bettcher has also joined the company as sales promotion manager.

A. C. Wiebe has retired as New York representative of the F. J. Stokes Machine Co., because of illness. His position will be temporarily filled by J. C. Coleman, manager of Stokes' New York office, assisted by Richard Kimber and members of the company's Philadelphia office.

J. F. Nicholl has been promoted to general manager of the Lumite Div. of Chicopee Manufacturing Corp., 47 Worth St., New York, N. Y. He was formerly manager of the Decorative and Upholstery Fabric Section. George H. Day II, formerly sales manager of the Insect Screen Cloth Section, will now direct the Lumite Insect Screen and Lumite Decorative Fabric sales as general sales manager.

W. S. Traylor of Hercules Powder Co. has been appointed resin supervisor at the company's new synthetic resin plant at Burlington, N. J.

Harry A. Barth, previously assistant to the director of merchandising in the W. T. Grant Co., 1441 Broadway, New York, N. Y., has been assigned other responsibilities in the company and is succeeded by Dr. A. Frank Tesi, who will be in charge of testing, quality control, and merchandise development. Dr. Tesi was formerly with the American Standards Assn. and the Mellon Inst.

R. M. McGuire, vice-president of the Pantasote Co., Passaic, N. J., has moved his office to Detroit, Mich., to handle Pantasote's automotive business and to direct sales throughout the Middle West.

Deceased

Les C. Wilson, 47, president and sales manager of Calresin Corp., Culver City, Calif., April 27.

Lester J. Felsenthal, 62, at Glencoe, Ill. President, G. Felsenthal and Son, Inc., Chicago, Ill.

MEETINGS

June 21-25—Annual meeting of the American Society for Testing Materials, Detroit, Mich.

July 28-July 1—Thirty-Fifth Annual Convention of the American Electroplaters' Society, Atlantic City, N. J. Technical sessions will include papers on plating of plastics. Registrants are not required to be members of the Society.

Sept. 27-Oct. 1—Third National Plastics Exposition, Grand Central Palace, New York, N. Y.

Fisherman's Luck . . .

Cut-out view shows construction; note product visibility.

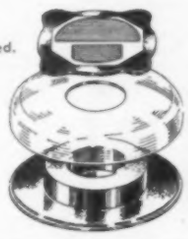
PAT. No. 2124512
Other Patents Pending

As utility line holder and reel.

Showing parts detached.
PHENOLIC

POLYSTYRENE

PHENOLIC



You don't need to be a fisherman to appreciate *this* story. When the makers of Cortland's Fly Rod Line asked Northern's cooperation in perfecting a new deluxe case, fishermen everywhere were in luck. For Northern skill and ingenuity not only designed, engineered and molded a plastic container providing *maximum protection* and *product visibility*, but one with a *permanent re-use value* — a unique plastic reel for transferring line from container to fishing reel, and for storing and carrying the line after use. For open display, base is simply set on inverted transparent plastic cover — in seconds. If you are casting about for better ways of doing things, drop us a line. To keep up with the times, use plastics; to keep ahead, use Northern's designing, engineering and molding facilities.

Northern INDUSTRIAL CHEMICAL CO.

39 Years of Plastic Molding Experience

7-11 ELKINS ST. SO. BOSTON, MASS. SO. 8-4240

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P.O. Box 476, Rochester 2, N. Y. Tel. Charlotte 3270

P.O. Box 5604, Phila. 29, Pa. Tel. Victor 8679

EEMCO PRESSES

are designed for

ECONOMICAL PRODUCTION

EEMCO Hydraulic presses are built in all sizes for compression and transfer molding and other special uses. They can be furnished with self-contained individual pumping units or to be used with your present hydraulic system. Skillfully designed by qualified engineers EEMCO presses are extra heavy in construction. They save you money by increasing production and by lowering maintenance and operating costs.

LABORATORY PRESS

EEMCO hydraulic presses are built for specific production needs. Submit your requirements for prices.

PRESSES • MILLS
CRACKERS • WASHERS
CALENDERS • REFINERS

EEMCO ERIE ENGINE & MFG. CO.

953 EAST 12th ST., ERIE, PENNA.

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

WANTED: PLASTIC Scrap or Rejects in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED — Large engineering plastics firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment, whole or in part. Personnel retained where possible, strictest confidence. Box 1230, 1474 Broadway, New York 18, N. Y.

FOR SALE—Compact Molds for injection molding. For molding large round compacts and other styles. Some styles with tools, puffs, sifters, cartons and parts. Will sell cheap. Affiliated Enterprises Co., 83 Van Braam St., Pittsburgh 19, Penna.

FOR SALE: Thropp 16" x 36" 2 Roll Rubber Mill; 500 ton Hydr. Molding Press 42" x 48"; Field 500 ton 25" x 30"; Francis 200 tons; 24" x 18"; Thropp 175 ton 36" x 36" 6 opening. Also presses 20 to 250 tons from 12" x 12" to 36" x 36" & 40 ton Broaching Press. Watson-Stillman Hor. 4 plgr. 1" x 2" x 4" H. & L. Pressure Pumps; HPM 1⅜" x 6" vertical triplex 10 GPM 2700 lbs; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc., Elmes 1" x 4" & 1¼" x 4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. & 5500 lbs., Elmes 2" x 6" hor. 30 GPM, 2500 PSI.; Rumsey 4½" x 8" vert. Triplex 65 GPM 900 lbs; Elmes 2½" x 4" hor. 17 GPM 850 lbs; Hydr. Steam Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum; Stokes type 200 Automatic Molding Press, Stokes Rotary Preform Tablet Machines 1-3/16", 1¼" and ⅝", also single punch; Injection Molding Machines 2 oz. to 12 oz.; Baker Perkins jacketed Mixers 200, 100, 50, 20 & 9 gals. capacity; New and used Rotary Cutters; Rubber Mills; Calenders, Banbury Mixers, etc.; Heavy duty Mixers; Grinders; Pulverizers; Gas Boilers etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 90 WEST STREET, NEW YORK 6, N. Y. WOrth 2-5745.

FOR SALE Hydro Pneumatic Accumulator, 12 Gal. 3500#. 25 Ton "C" Frame Type. High Speed Self Contained Hyd. Press Ball & Jewell Rotary Cutter. Model R Stokes Tablet Machine. 50 Ton Press with 18" x 18" Electric Plates. 100 ton 20" x 20" press. Racine Pumps, Boosters, Valves, Logan Pumps, Valves. Self-Contained—200 H.P. 78 Gal. 3000# Pump. 200 H.P. 200 Gal. 1500# Pump 18" x 15' Accumulator 1500#.—15" x 11' Acc. 400-2000", 6" x 9' Accumulator-2000#. 300 Ton Press 20" Ram, 8" Stroke, 24" x 20" Platen. 500 Ton—1000 Ton Hobbing Press—Hele Shaw Variable Pressure 33 GPM 2500#—Vickers Oil Pumps 17 GPM 500 to 1000#. Elmes Horo. 4 Plunger 6—Gals. 5000#.—Stillman 12"x12" Laboratory Presses. Aaron Machinery Co., 45 Crosby St., NYC.

DO YOU NEED a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending, and Hobbing? Many sizes hydraulic presses and pumping units available. New motors from 2 to 7½ H.P., 220 volts, 3 phase. Whatever it may be, if it is hydraulic, see Sal-Press Company, 388 Warren Street, Brooklyn, N. Y.

HYDRAULIC SERVICING

Hydraulic installations—repairs modifications and hydraulic power units built to specifications by hydraulic specialists.

Hydraulic Service Company of N.Y.
4317 Richardson Ave., Bronx 66, N.Y.
Telephone: MUrray Hill 2-0276

AIRTRONICS PREHEATERS for sale one model CB 1½ KW—2 model KH 2½ KW—two load settings—these machines are in good operating condition. Reason for sale: equipment no longer needed. Reply Box C636, Modern Plastics.

FOR SALE—Electronic Sealing Equipment. RCA Radio Frequency Generator Model 2BH. Two KW Output. Complete with RCA 14-inch die sealer. Also Kabar RF Generator. One KW Output. Complete with Standard Kabar die Sealer. Also Several 500 Watt Kabar RF Generators only. Excellent condition. Reasonably priced. Box C638, Modern Plastics.

FOR SALE—1—Watson-Stillman 225 ton, 30" x 28" platen, 16" ram; 3—Southwark 225 Ton, 31" x 19" platens, 16" ram; 1—Burroughs 150 ton, 28" x 13" platens, 2—9" rams; 2—Baldwin-Southwark 110 ton, 24" x 18" platens, 11" ram; 3— Watson-Stillman 60 ton, 12" x 12" platens, 8" ram; 1—12 ton, 15" x 15" platens, 3½" ram; 2—Steam Driven Hydraulic Pumps, 15 and 30 GPM, 3000# and 5000#; 3—Baker Perkins 50 and 100 gal. Jacketed double arm Mixers; 25—Stokes Preform Presses "R", 2½"; DD2, 23 punch 1-3/16"; DD2, 31 punch 15/16"; 2—Stokes DD2 Rotary, 1-3/16"; RD4 Rotary, 1"; Colton Rotary, 35 punch, ¾"; Day Readco, from 4 to 150 gal. double arm Mixers; 2—Ball & Jewell #0 and #1 Rotary Cutters. BRILL EQUIPMENT COMPANY, 225 West 34th St., N. Y. 1, N. Y.

TUMBLER MOLD WANTED. State number of cavities, type of mold, condition and price. Send samples at once. Superior Plastics Division Commonwealth Plastics Inc., 426 North Oakley Blvd., Chicago 12, Illinois.

FOR SALE

Stock of Saran Tape mfg. by National Plastics Products Company. 2" x .030"

1200 lb Red
1000 lb Green
3900 lb Yellow

50¢ per lb fob our factory

Timmerman Lumber & Mfg. Co.
Hibbing, Minnesota

HYDRAULIC PRESSES, 30"x52", 24" ram, 700 tons; 30" x 30", 20" ram, 1000 tons; 30" x 30", 17" ram, 340 tons; 20" x 24", 19" ram, 350 tons; 42" x 42", 16" ram, 250 tons; 36" x 36", 16" ram, 250 tons; 36" x 36", 12" ram, 141 tons; 36" x 52", 14" ram, 385 tons; 26" x 30", 15" ram, 177 tons; 20" x 20", 13" ram, 166 tons; 24" x 26", 10" ram, 118 tons; 19" x 24", 10" ram, 78 tons; 23" x 17", 8" ram, 75 tons; 22" x 15", 8" ram, 75 tons; 15" x 15", 8" ram, 75 tons; 12" x 12", 7½" ram, 50 tons; 12" x 12", 6½" ram, 42 tons; 8" x 9½", 4½" ram, 20 tons; 16" x 16", 3½" ram, 12 tons; New Dual Pumping Units; HPM Triplex 1½ GPM 2500#, Robertson Duplex 1-2/3 GPM 4000#; Worthington 2½ GPM 4000#, W&S Duplex 1 GPM 2500#, 4 plunger 6 GPM 2000#; Laboratory Presses all sizes; Laboratory Mills, New Units 6" x 12" M.D., 10" x 24" and 16" x 30", 36", 40" and 42" Mills with Drives; Extruders, Plastic; NRM 1½" and 2½" units; W&P unjacketed sigma blade 100 gal. Mixer; Preform Machines; Stokes R, Colton 5T; Hydro-Pneumatic and weighted type Accumulators, etc. HIGHEST PRICES PAID FOR YOUR USED MACHINERY. Universal Hydraulic Machinery Company, 285 Hudson St., N. Y. C. 13.

#1 BANBURY MIXER, chromium plated trough, stellite tipped blades, with 40 h.p. motor and starter; 2—Stokes No. 280 F toggle type Preform Presses 80 ton motor driven. Send for news flash. BRILL EQUIPMENT COMPANY, 225 WEST 34th STREET, NEW YORK 1, N. Y.

WANTED: PRODUCTION MANAGER or plant superintendent for plastic molding concern located in Ohio. Must be thoroughly experienced in compression and injection molding and the finishing of molded parts. The man we want should have a good background in the tooling and production end of the plastics business, and should be thoroughly cost-conscious. We have a good opportunity at a good salary for the right man. Reply Box C643, Modern Plastics.

WANTED:—Hydraulic Presses 14" to 36" rams, steel cylinders preferred. Box C639, Modern Plastics.

WANTED, SINGER heat sealing machine in good condition for spot cash. Reply Box C640, Modern Plastics.

FOR SALE—New Universal Laboratory Mill 6 in. dia. rolls, 12 in. face with 5 hp; 3 ph AC 60 CY 220 v motor mounted on stand. Rolls ground and polished; diameter roll neck 3 inches. Also gas heating unit to create steam for mill. Will sell at sacrifice. Reply Box C641, Modern Plastics.

FOR SALE.
1—16 x 30 Thropp Mill #8491 with extra set of rolls and bearings—complete with 75 H. P. Motor direct connected and starter for 220 V-60 Cycle 3 phase.
1 Robinson saw tooth crusher Size 13 with motor and drive—practically new.
1 Gemco blender complete with 7½ H.P. Motor practically new.
2—#5½ Colton Preforming machines complete.
1—Worthington 6 x 4 x 6 Vertical triplex pump 250# p.s.i. 50 G.P.M.
Reply Box C642, Modern Plastics.

FOR SALE—INJECTION MOLDING MACHINE

4 oz. H.P.M. Injection Molding Machine good condition. Operating full time, are replacing with larger machine. Available for inspection any time. Midwest location. Priced for immediate sale at $4,500.00. Reply Modern Plastics Box C635, Modern Plastics.

FOR SALE—1—Watson Stillman Hydro-Pneumatic High and Low Pressure System, complete, 3000#; 12—Baker Perkins 100 gallon Plastic Mixers; 1—12" x 12" Preas 7" Ram, Steel Heated Platens and Hand Pump attached; 2—24" x 24" Adamson, 10" ram, 2—opening Hydraulic Press; 2—La Pointe Hydraulic Pumps, 150 G.P.M.—2000 lb. pressure direct motor driven to 125 HP AC motors; 1—French Oil Hydropneumatic Accumulator; 1—14" x 24" Press, 9" ram; 2—Royale #3 Perfected Tubers; 1—Royale #½ Perfected Tuber; 1—16" x 42" Thropp Mill; 2—B & J #1 Rotary Cutters; 1—Cavagnaro 2 cylinder 10" diameter Vertical Hydraulic Extruder; 1—Devine #11 Vacuum Shelf Dryer, 17 shelves heated 40" x 42"; 1—Farrell 6" x 12" 2-roll Rubber Mill; 1—48" x 48" 3—opening Hydraulic Press, 4—10" diameter rams, 300 tons; Dry Powder Mixers; Pulverizers; Grinders; etc. Send for complete list. Box C581, Modern Plastics.

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Injection Molding Plant

Complete and Operating, new building, National reputation. Excellent buy for interests seeking expansion in plastic field. Reply Box C637, Modern Plastics.

EXTRUSION-TECHNICAL salesman. 6 years experience customer contact, engineering, production ad management. Available 6 weeks. Box C646, Modern Plastics.

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A new 8 Cavity Wall Tile Mold
4¼ x 4¼ x 16 for 8 oz.
Injection Molding Machine or over.
Sacrifice for fast buyer!

Call Mr. Karp
Chickering 4-1162

PLASTIC CHEMIST expert in testing, separating and reworking plastic scrap materials by own special inexpensive method. Have had many years experience holding leading position with large company. Box C644, Modern Plastics.

(Continued on Page 224)

PROVED!

...for fast, accurate molding!

-the new DeMattia Injection Presses

The fact that DeMATTIA Molding Presses and Molding Equipment are specified year after year, by molders throughout the world is proof of their dependability. One sure way to better plastic production is the specification of DeMATTIA machines and DeMATTIA molds in your plant.

Rugged Hydraulic Horizontal Press—

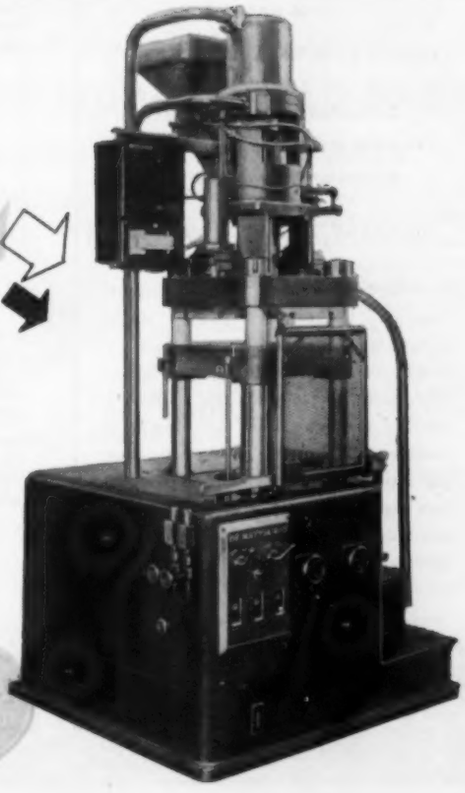
An efficient DeMATTIA press featuring proper design, finest workmanship and materials and built to function smoothly in heavy, continuous service. Solid base and tension members, open feed for visual inspection and fast, contamination-free color changing are only a few of the many advantages. Available in 6, 12 and 24 ounce capacities.

New Vertical Injection Press—

Suitable for general injection molding, the DeMATTIA Vertical Type performs excellently on exacting insert work. Compact design requires a minimum of floor space in the molding plant. Furnished in 4 and 12 ounce capacities. Complete data and specifications sent promptly on request.

DeMattia Complete Molding Equipment—

DeMATTIA Machines for the molding industry include injection presses, scrap granulators and cutters for quick handling of even large scrap material. DeMATTIA scrap grinders make it possible for molders to save valuable storage space and eliminate costly processing charges. For the molder requiring assistance on design, DeMATTIA will plan and make molds that will help assure successful molding. WRITE FOR ILLUSTRATED LITERATURE.



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1 Mill 18" x 40" in good operating condition—recently overhauled—fully equipped—220 volt—60 cycle—3 phase—75 H.P. Induction Motor, Jones enclosed Gear Reducer, Starting Box Brake and all other associated electrical wiring and controls, available for inspection New York City area. Box C653, Modern Plastics.

X-RAY AND FLUOROSCOPIC examination of plastics in your own plant if located in N. Y. area. Reveals shrinkage, insufficient material, uneven distribution of fibrous material, alignment of metal inserts and metallic inclusions. Particularly useful for eliminating small metallic inclusions in phonograph record biscuits. PORTABLE X-RAY SERVICE, 98-120 Queens Blvd., Forest Hills, L. I. New York.

IF YOU HAVE good hydaulic presses with modern pumping equipment, send me specifications of same with photo. I will see to it that you will get the best price available. Sal's Press, 388 Warren Street, Brooklyn, N. Y.

WANTED

PLASTICS COLORING MAN

Young technical man familiar with operation of G. E. Spectrophotometer in plastic coloring. Knowledge of plastics processing and molding desirable to aid in expanding plastics development department in large chemical corporation. Reply Box C654, Modern Plastics.

FOR SALE: #8½ D Gorton Duplicator (1946); 4-Bridgeport Vertical Millers; M35A Diecaster, 5" x 6" Die Block; 50 Ton Kux Press, Model 74-1 (1946); K. O. Lee Tool & Cutter Grinder (1945); 3H Kearney and Trecker Vertical Miller (1943). Many others. We buy plants and equipment. AUSTIN D. LUCAS & COMPANY, INC., 125 Lindley St., Bridgeport, Conn. 4-9417.

REPRESENTATIVES TO SELL plastic buttons, ring fish eye, and poker chips. Compression molding facilities are available 150 ton and 200 ton presses to individuals having their own molds and desiring to mold their own articles. Reply Box C655, Modern Plastics.

THIS COULD BE YOUR BIG OPPORTUNITY—We have a complete small plastics plant with brand new 9-oz. Injection Machine, Scrap Grinder, Vibra-Veyor; a minimum of floor space; everything wired, connected, and ready to go to a man with experience, aggressiveness, and a determination to succeed. We are perfectly willing to consider a proposal for him to operate this plant with the hope that it will grow into something larger. Location is Midwest. Write us in detail giving us your ideas on how to get together. Reply Box #C656, Modern Plastics.

EXTRUSION ENGINEER—Must know all phases of extrusion—good proposition for right man. New York factory. Give full details, Box C666, Modern Plastics.

INJECTION MOLDS WANTED—Novelty Toy and Similar Dies Furnish Complete Details. Box C657, Modern Plastics.

REPRESENTATION WANTED
for our nationally known Mold and Die Polishing Service. Representative must now be selling to mold and die makers, die casters, plastic molders. Exclusive territories now available: New York City, northern New Jersey, northeast Pennsylvania, Illinois, most points West and South. Acme Scientific Company, 1450 West Randolph Street, Chicago 7, Illinois.

FOR SALE—New 2 cavity plunger type mold for Electric Iron Handle. Will sacrifice for ½ original cost. American Plastics Engineering Corp., 3020 E. Grand Blvd., Detroit 2, Michigan.

WANTED: — SALES PROMOTION MANAGER with practical selling experience and broad knowledge of packaging field, to promote sale of molded plastic containers for midwest manufacturer. Good opportunity for man with ambition and imagination. Box C658, Modern Plastics.

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SALES MANAGER AVAILABLE—Excellent record of ferreting out the places where business can be found coupled with sound knowledge of production in acetate containers, folding cartons and injection molding and fabricating of plastic industrial parts. Ability to design consistent with production limitations included in the same package of energy, versatility, tact and original thinking. Experience over the past sixteen years includes administration and advertising along with sales management. Age 43. Free to locate wherever opportunity is most interesting. My associates know of my intentions. Your reply will be held in confidence. Box No. C660, Modern Plastics.

WANTED—Man experienced on finishing small molded plastic pieces. Must be able to make mechanical set ups and supervise dept. Mayfair Molded Products Corp., 4440 N. Elston Ave., Chicago, Ill.

FOR SALE—2 K. W. Thermax, high frequency heating unit, 2-10 megacycle range, a sturdy flexible unit suitable for production or experimental work. New condition, reasonably priced. Write—W. H. Hutchinson & Son, Inc., 1031 North Cicero Avenue, Chicago 51, Illinois.

WANTED — MANUFACTURERS REPRESENTATIVE By Plastic Molding concern with excellent facilities for volume molding of small thermosetting plastic items. Representation desired for proprietary items and custom molding. Experience and contacts essential. Commission basis. Give complete details in reply. Box C661, Modern Plastics.

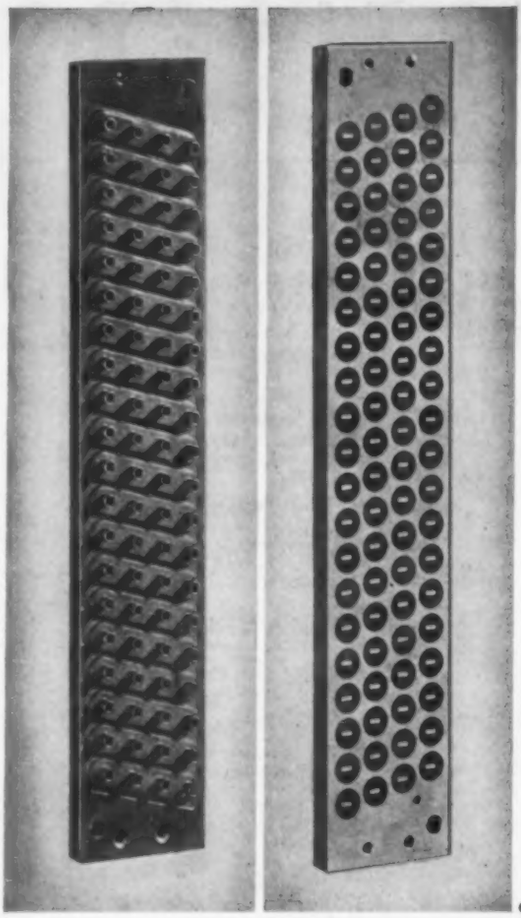
THOROUGH PROFESSIONAL advice, product development, research, control on contract basis by experienced high class chemist, Ph.D. Box C662, Modern Plastics.

WANTED—REPRESENTATIVES for manufacturer of plastic point-of-sale displays and edge lighted plastic signs. Prefer man already calling on trade with non-competitive line. P. M. D. Corp., 23 West Maryland Street, Indianapolis, Ind.

AVAILABLE—Plastic engineer with wide exp. 8 years in the injection field, familiar with all phases injection molding, plant organization and set up, estimating production and costs, machs, molds, materials etc. Recently completed setting up a plant in South America. Box C663, Modern Plastics.

MIDWEST COMPRESSION—injection molding company has opening for aggressive experienced supervisor in press room. Must be able to take complete charge of production. We also have opening for experienced finishing room supervisor. Must know latest methods and machines. These openings will develop into good paying jobs for right fellow. Men under 35 preferred. Box C664, Modern Plastics.

WANTED, SALES REPRESENTATIVE in Cleveland territory by one of the foremost molders of all available plastic materials by Compression, Injection, Transfer and High Speed Plunger. Box C665, Modern Plastics.



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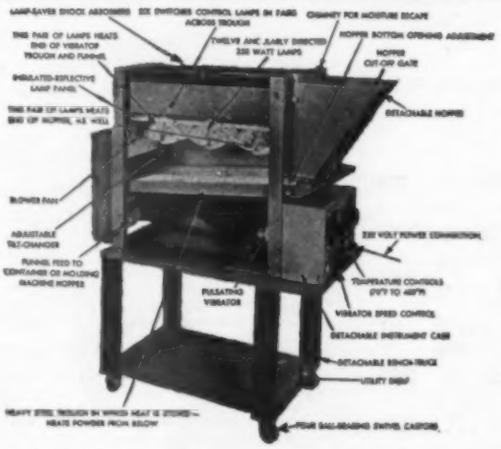

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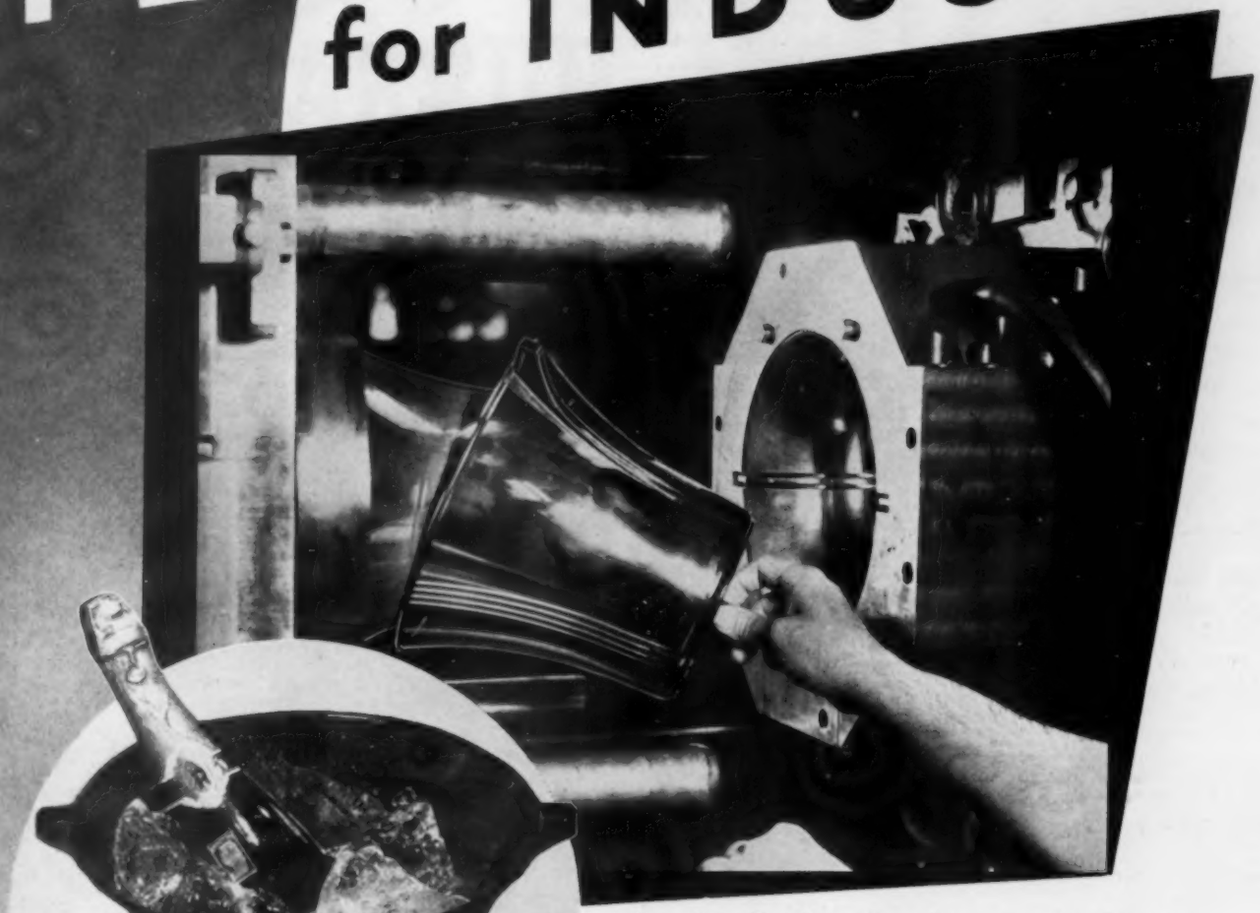

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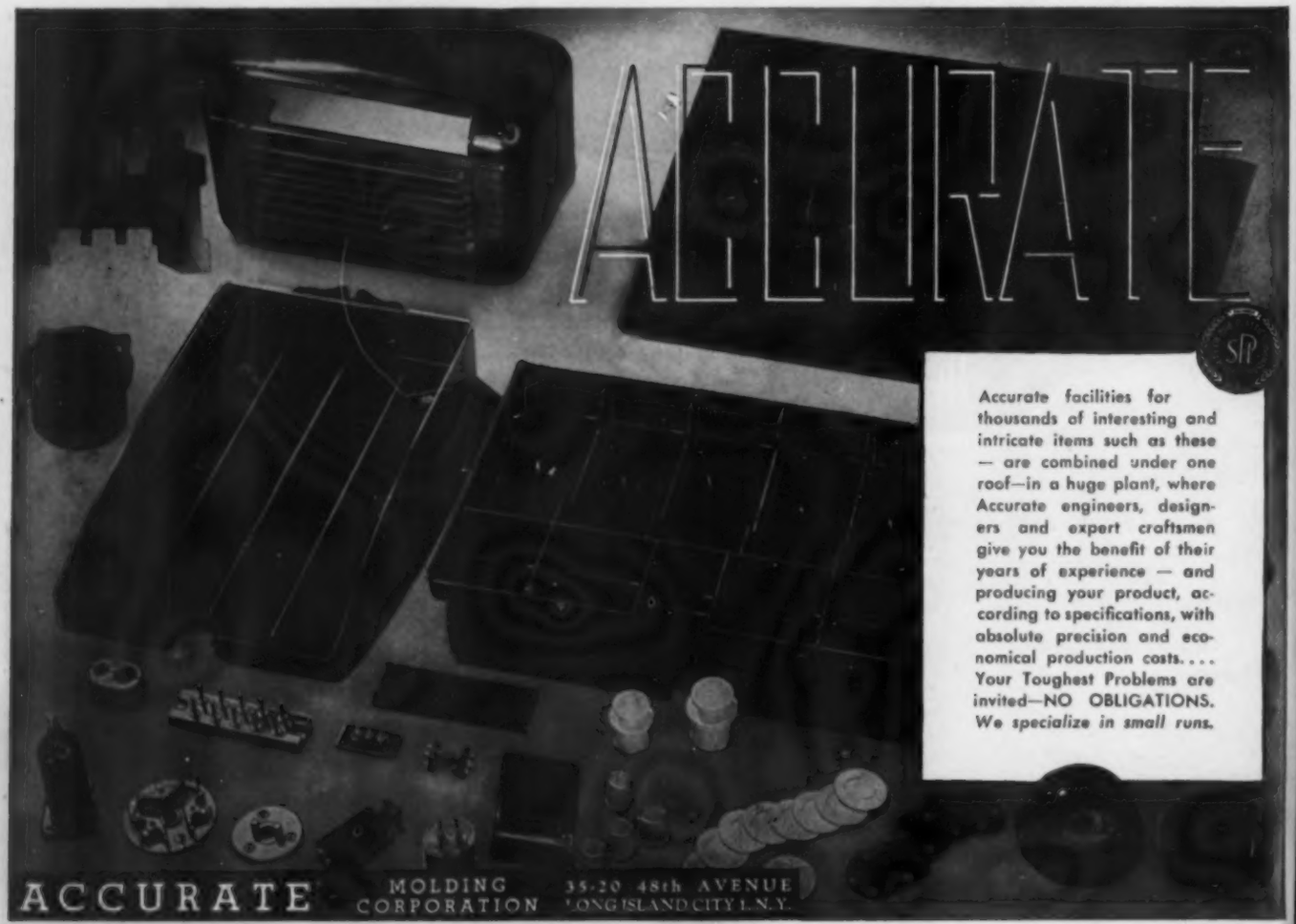
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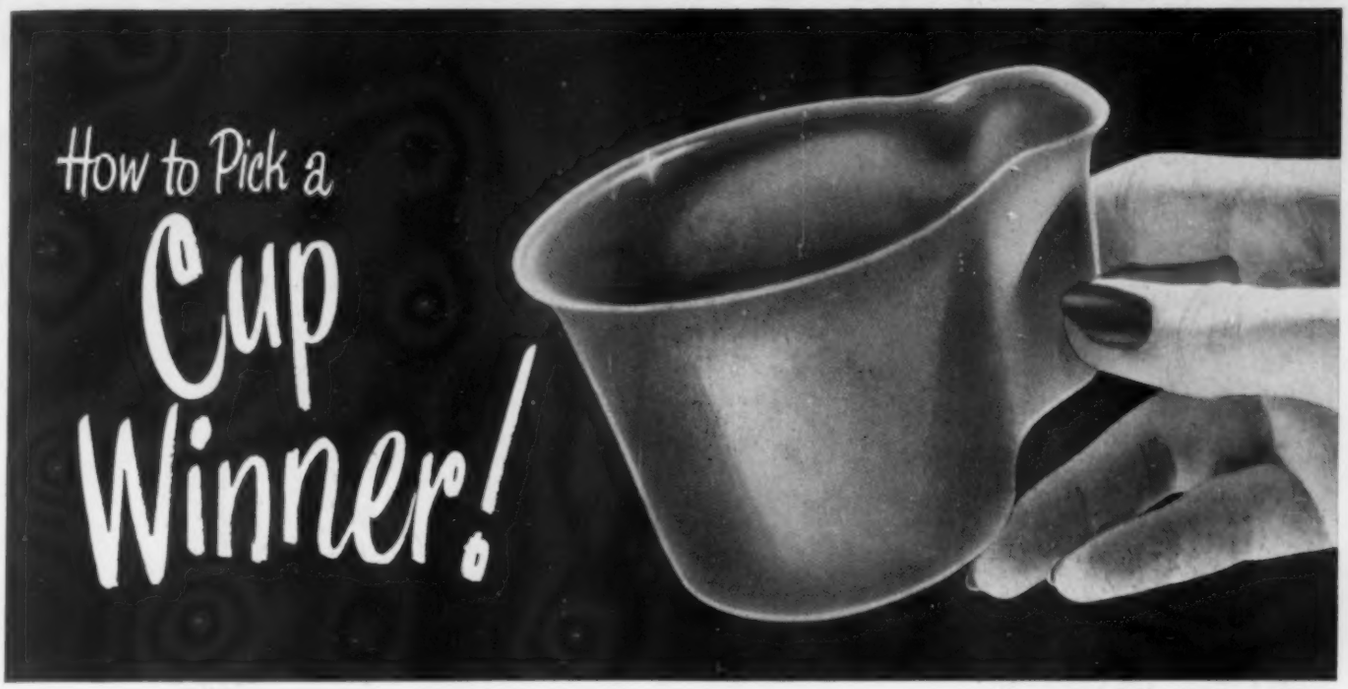

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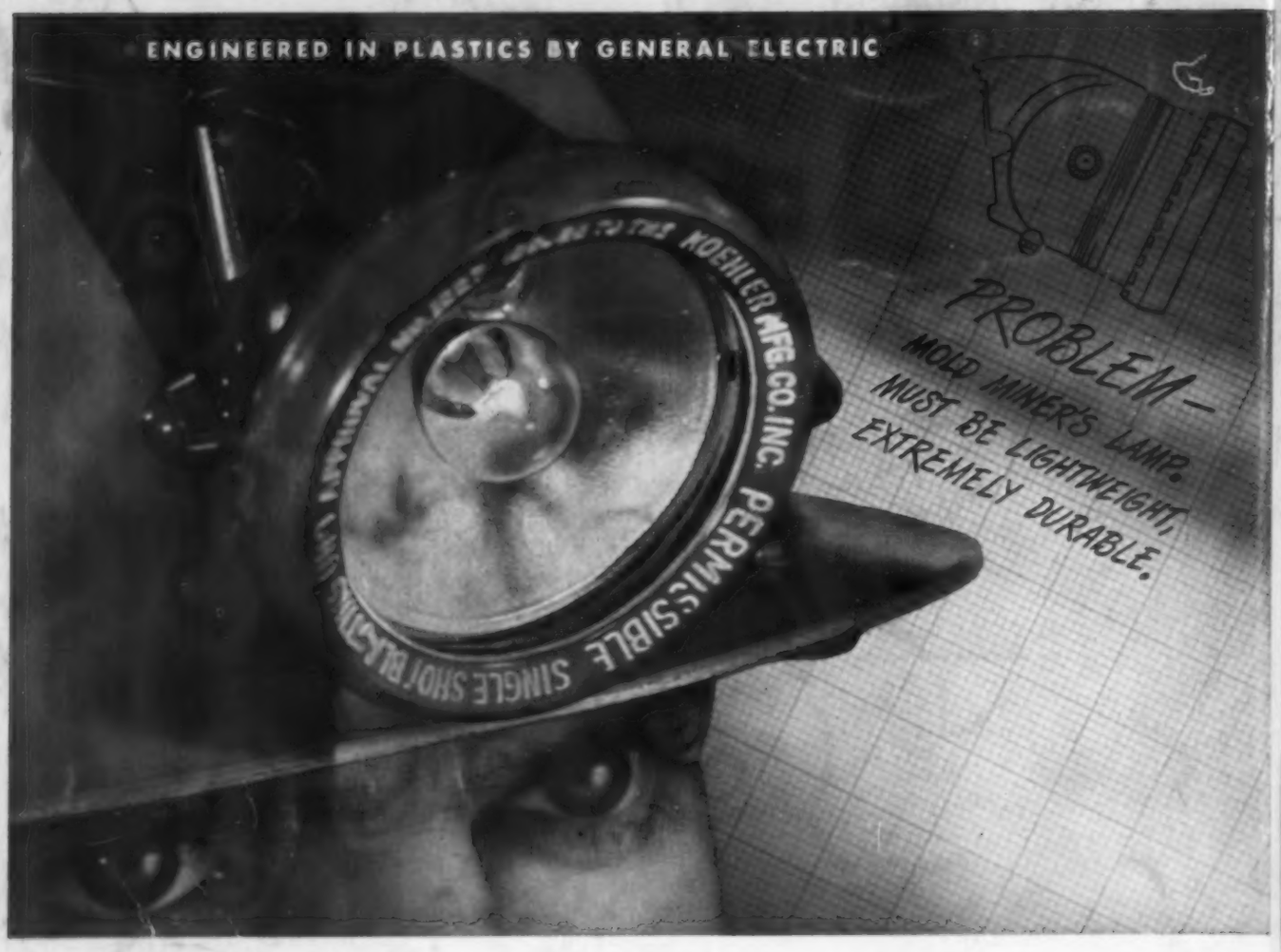

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